ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World!

There are stirring and perhaps painful days ahead for the electrical industry. President Roosevelt has not forgotten his utility viewpoint. Political pressure, rate agitations and competition still prevail. Manufacturers, wholesalers and dealers find red balance sheets still persist. Industry executives are harassed and industry men and women are worried. All this is a part of the times. Calmness, courage and confidence must be maintained, however, for these conditions are temporary. The electrical industry is a necessary and permanent part of modern civilization. It has a great future. Let us hope that we do not lose perspective while we fight for survival under these temporary conditions.

●

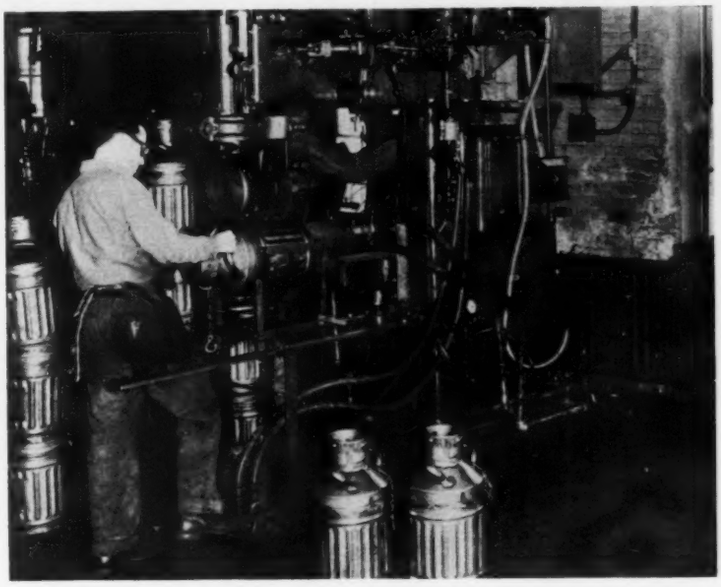
We have just returned from a visit to the Century of Progress at Chicago. It is going to be a great success. It stresses electricity and electrical utilization. Every electrical man will find a visit profitable and valuable.

●

Who said hard times? At the final N.E.L.A. National Engineering Section meetings in Detroit last week more than 300 engineers were in attendance. They worked hard, they had new ideas, they went back home with valuable aids. The new E.E.I. must keep up these essential meetings of men from the properties.

●

Capable and well-informed on his subject, Dean Taylor has fought the good fight in our columns for some months now in the interests of purchased versus Diesel power. There is still something to be said on both sides, and that something is not salesmanship, but cold, cold economics.



Intermittent line welding with electron tube control

APRIL 15, 1933

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VOLUME 101 . . . NUMBER 15

Exposing the Omissions in "Savings" Contracts for Diesels 476
BY DEAN TAYLOR, *Utility Management Corporation*

Removing Heat from High-Intensity Light 480

Service Reliability Keynote of Anthracite Breaker Design 484
BY RAYMOND A. HOPKINS

This Matter of Quality in Appliances 488
BY EARL WHITEHORNE

Unit Costs Based on Construction, 1926-1931 481
More Testimony for Ground Wires 482
Builds Rural Line for $865 per Mile 483
Electricity Welds in Unique Way .. 487
Tacoma Plant Estimated at $80 per Kilowatt 489
Termination of Control Cables at Switchboards 490
Air-Arc Power Rectifier for 150 Kv. 491
World Statistics of Public Utility Energy Output and Use 492
Synchronous Condenser Raises System Generating Capacity 494

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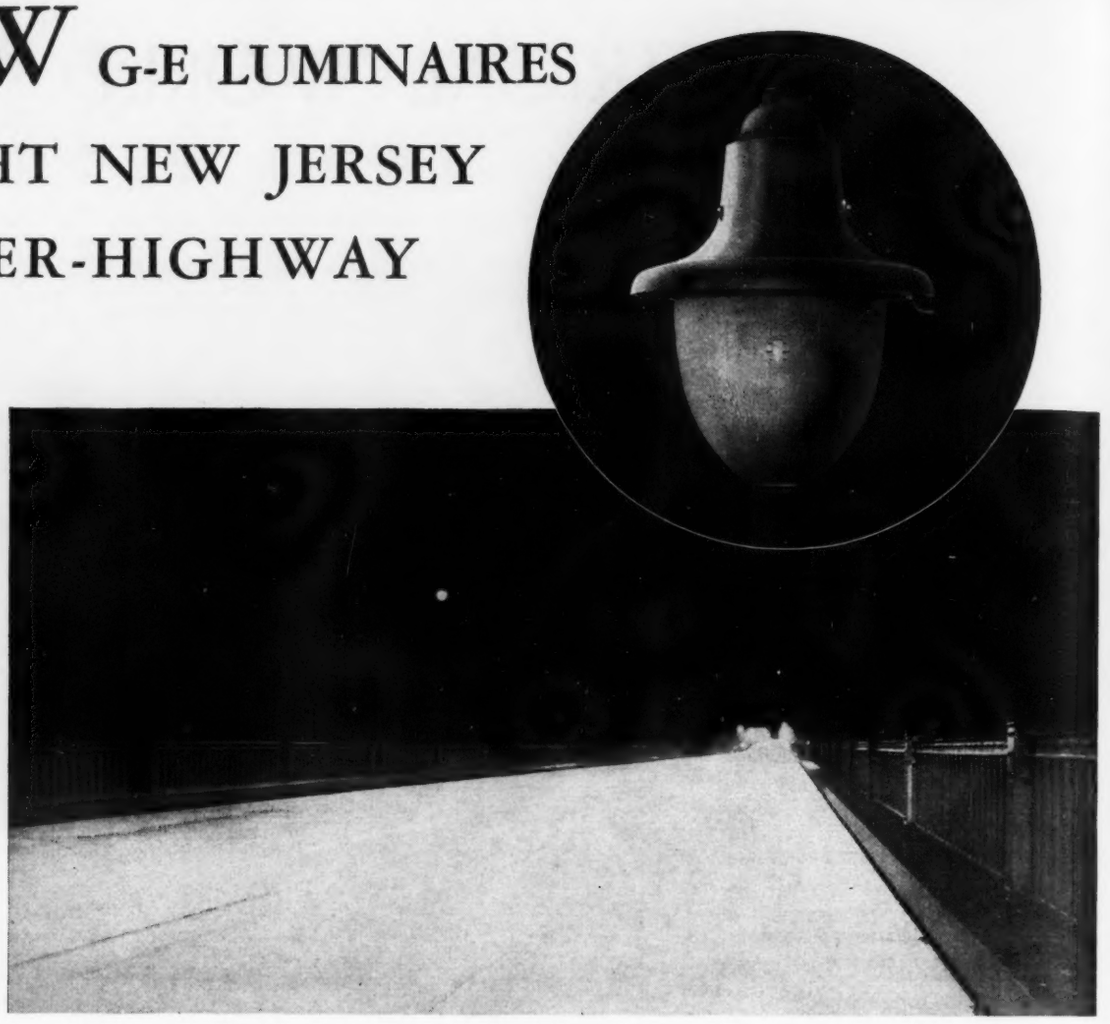
NEW G-E LUMINAIRES LIGHT NEW JERSEY SUPER-HIGHWAY



High Efficiency and Low Maintenance Make These Units Ideal for Highway and Main-artery Illumination

TWO hundred G-E luminaires provide ideal lighting on the elevated section of New Jersey's high-speed super-highway extending between Trenton and the Holland Tunnels at Jersey City.

These luminaires, the new Form 52 Novalux units with 11½-inch B-symmetric rippled bowl refractors and internal reflectors, have the following outstanding features:

1. The refractor is designed to give ideal distribution of light on the roadway; the reflector, to give maximum efficiency.
2. An external mechanism for adjusting lamp position, together with a sight hole in the refractor, makes possible quick and accurate adjustments of the luminaires.
3. The rigid hinge and latch refractor holder assures a tight fit against the casing and makes possible relamping from the ground.

General Electric illuminating engineers, who designed this luminaire for highway and main-artery illumination, and who planned the New Jersey super-highway lighting installation, will gladly help you plan efficient and economical lighting on streets and main arteries in your territory. Address General Electric, Dept. 6-201, Schenectady, N. Y.

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GENERAL ELECTRIC

ELECTRICAL WORLD

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for the Week Ending

April 15, 1933

Roosevelt Urges Tennessee Development, Bills Now Before Congress

REPLETE with idle industrial plants, confronted with electric power generating facilities more than adequate for the requirements of many years to come, needing not production facility developments but consuming power and the desire to purchase goods, America is offered, and will undoubtedly get, a great government - inspired - and - controlled development of the Tennessee Valley, bringing more plants, more available power, more production facilities to satisfy some nebulous dreams in high places for an American Ruhr.

"Continued idleness of a great national investment in the Tennessee Valley leads me to ask Congress for legislation to enlist this project in the service of the people," said President Roosevelt in his message to the legislators this week.

"It is clear that the Muscle Shoals development is but a small part of the potential public usefulness of the entire Tennessee River. Such use, if envisioned in its entirety, transcends mere power development: it enters the wide fields of flood control, soil erosion, afforestation, elimination from agricultural use of marginal lands and distribution and diversification of industry.

"In short, this power development of war days leads logically to national planning for a complete river watershed involving many states and the future lives and welfare of millions. It touches and gives life to all forms of human concerns.

"I, therefore, suggest to the Congress legislation to create a Tennessee Valley Authority—a corporation clothed with the power of government, but possessed of the flexibility and initiative of a private enterprise.

"It should be charged with the broadest duty of planning for the proper use, conservation and development of the natural resources of the Tennessee River drainage basin and its adjoining territory for the general social and economic welfare of the nation.

"This authority should also be clothed with the necessary power to carry these plans into effect. Its duty should be the rehabilitation of the Muscle Shoals development and the co-ordination of it with the wider plan.

"Many hard lessons have taught us the human waste that results from lack of planning. Here and there a few wise cities and counties have looked ahead and planned. But our nation has 'just grown.' It is time to extend planning to a wider field, in this instance comprehending in one great project many states directly concerned with the basin of one of our greatest rivers.

"This in a true sense is a return to the spirit and vision of the pioneer. If we are successful here we can march on, step by step, in a like development of other great natural territorial units within our borders."

Enabling bills introduced

Following Mr. Roosevelt's message two separate measures were introduced, one by Senator Norris and the other with three sponsors in the House of Representatives. The principal difference between these two measures is that the House would provide for an immediate appropriation of $10,000,000 and issuance of $50,000,000 bonds to bear an interest rate of 3 per cent, the funds to be used to construct Cove Creek Dam and Dam No. 2. The Norris bill, on the other hand, provides for a study of Dam No. 2, and then a bond issue, if necessary. The amount of this bond issue is not fixed.

Both measures would establish a board of three members appointed by the President, which would be known as the Tennessee Valley Authority of the United States. Presumably this would function as does the Hydro-Electric Power Commission of Ontario, achieving full power at one instant though and not by slow growth as did the commission.

Presumably subject to minor changes as Congressional debates and hearings may dictate, there is indicated the probable establishment of and provision for: Production of fertilizers and sale at cost plus; extensive experimental and research work; production, distribution and sale of electric power, and energy contracts with maximum life of 30 years.

Proponents ecstatic

"The Muscle Shoals message was the greatest humanitarian document ever to come from the White House," said Senator Norris, unmindful of Lincoln and Wilson.

"I thank God," said Representative McReynolds, chairman of the foreign affairs committee, who happens to be from Tennessee, "that we now have in the White House a man who looks at this great project from a national rather than a sectional viewpoint."

"It marks a turning point in history," declared Representative Rankin of Mississippi, with an eye to further developments.

Alabama cities given right to use Muscle Shoals power

Bills passed by the Alabama Legislature allowing cities and counties to build and operate their own power and light plants became law April 6 with the signature of Goy. B. M. Miller. Advocates of the measures maintain that they are designed to enable Alabama to take advantage of the development program for Muscle Shoals as outlined by President Roosevelt. Under terms of the bills cities may build their own distributing systems and feeder lines to Muscle Shoals without regard to those already maintained by utility companies; one city or county may also serve another, and municipalities may borrow from the Reconstruction Finance Corporation or other lenders without charging the loan against their legal debt limits.

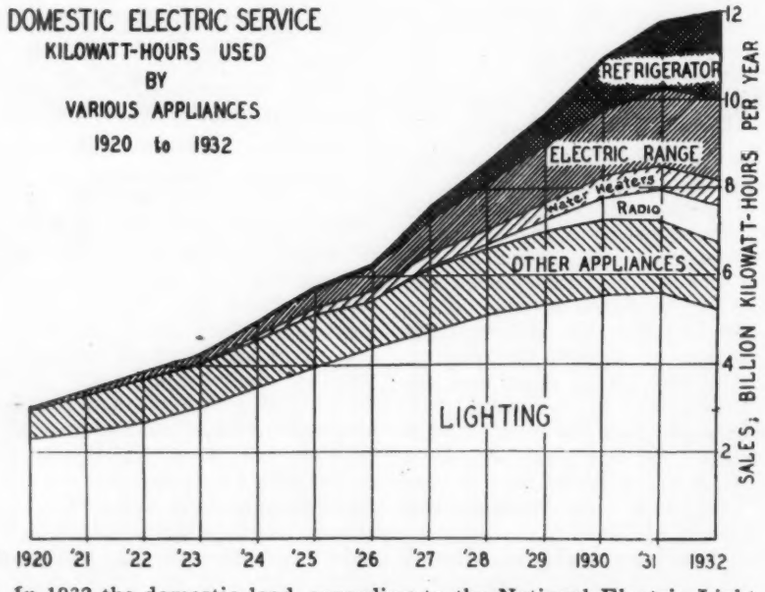
Ultra-Modern Station Planned for $55 a kw.

Steam-generating stations of the future are to be without alternator buses, steam headers or other shelter than that provided by the equipment housings, if a projected station involving these drastic departures and described to the power group, New York Section, of the A.I.E.E., this week by J. E. Goodale, electrical engineer, New York & Queens Electric Light & Power Company, foretells what is ahead. Mr. Goodale discussed a tentative scheme for the Astoria station on Flushing Bay to have an ultimate capacity of nine 200,000-kw. units, with the initial costs running about $55 per kilowatt, exclusive of land or a share of the existing coal-handling facilities of the adjacent gas plant.

So much has faith in the reliability of high-pressure steam and in the efficacy of electrical protection influenced the design that the whole station would consist of fully independent units, with 1,400-lb. boilers, triple-compound turbines, fans and other completely motor-driven auxiliaries. Almost the sole basis of linkage between units would be the novel plan to replace the conventional generator bus by interconnecting multiple secondaries of auto-transformers themselves connected directly through breakers to the respective generators.

Each auto-transformer (in the ultimate nine-unit plant) would have eight secondaries, so that each machine would be paralleled with each of the others without other reactance than afforded by the transformers. Off these interties would be tapped the feeders radiating to diversified service areas. Each feeder would therefore have two direct sources of supply and, inasmuch as the generator breakers permit operating the transformers with generators "off the line," there would be further opportunity to draw energy from other alternators through the coupling afforded by the auto-transformer secondaries. Station auxiliaries for each unit would be driven by 2,300-volt motors served from corresponding auxiliary secondaries on the auto-transformers.

Freezing in cold weather would be thwarted in the new design. Operators need not go outdoors, because the local housings of the units and underground passages afford the necessary shelter. So wide is the departure from conventional design that the architect's visualization looks like a cross between a Pittsburgh steel mill and the superstructure of a transatlantic liner. It has the vigor of one and the grace of the other.



In 1932 the domestic load, according to the National Electric Light Association, consisted of 57 per cent appliance use and 43 per cent lighting. That healthy appliance growth which began in 1926 is proving its worth. Lighting may fall off, but the radios, ranges and refrigerators keep right on as the utilities' best friends.

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Tax Duplications Burden Utilities

MULTIPLE TAXATION of electrical energy exists in at least 21 states, according to a report of the subcommittee on double taxation of the committee on ways and means of the House of Representatives. After referring to the 3 per cent sales tax imposed by the national government in 1932, the report continues:

"None of the states or territories has taxes theoretically comparable with this special sales tax levied by the federal government. However, about 21 states and Alaska and Hawaii have special franchise taxes on this subject, and from a practical point of view there are serious duplications. This duplication occurs because state taxes are almost universally levied on a gross receipts or kilowatt-hour basis. Seventeen states and Alaska impose franchise taxes which are in addition to property taxes and three states, Hawaii and the District of Columbia impose franchise taxes which are in lieu of property taxes. The general sales taxes of Mississippi and West Virginia reach electrical energy and are included in the above count. The committee reports:

Tax levies affecting energy sales

FEDERAL GOVERNMENT—Three per cent on sales price.

(Franchise Taxes in Addition to Property Tax)

ALABAMA—Four-tenths of 1 per cent on gross receipts (state); two-fifths mill per kilowatt-hour (state); 2 per cent gross receipts (city).

ALASKA—One-half of 1 per cent gross receipts.

CONNECTICUT—One and one-half per cent gross receipts.

DELAWARE—One-tenth of 1 per cent gross receipts.

IDAHO—One-half mill per kilowatt-hour.

MARYLAND—One per cent gross receipts.

NEVADA—Two per cent net income.

NORTH CAROLINA—Five per cent gross receipts.

OHIO—One and thirty-five hundredths per cent gross receipts.

OKLAHOMA—One-half of 1 per cent gross receipts.

OREGON—$1 to $3,000, based on gross volume.

PENNSYLVANIA—Eight-tenths of 1 per cent gross receipts.

SOUTH CAROLINA—Three-tenths of 1 per cent gross receipts; three-tenths of 1 per cent property value; one-half of 1 mill per kilowatt-hour.

TEXAS—One-half of 1 per cent gross receipts.

VERMONT—One-half of 1 mill per kilowatt-hour.

VIRGINIA—One and one-eighth per cent gross receipts.

(General Sales Taxes)

MISSISSIPPI—Two per cent gross receipts.

WEST VIRGINIA—Six-tenths of 1 per cent gross receipts.

(Franchise Taxes in Lieu of Property Taxes)

HAWAII—One-twentieth of 1 per cent gross receipts, plus one-fiftieth of 1 per cent stock valuation, plus one-half to 2½ per cent gross receipts as per charter.

CALIFORNIA—Seven and one-half per cent gross receipts.

RHODE ISLAND—One per cent gross receipts.

DISTRICT OF COLUMBIA—Four per cent gross receipts.

NEW JERSEY—Average property rate on gross income.

"Whatever the form of these taxes," concludes the report, "it appears that the burden falls principally on the consumer. If we assume, for instance, that all of the taxes shown in the above table are borne by the consumer, then we will find that the combined levy on electrical energy in California is 10½ per cent of gross receipts; in North Carolina, 8 per cent of gross receipts, and in the District of Columbia, 7 per cent of gross receipts. These are the higher levies. The minimum levies occur in the states of South Carolina, Alabama, Oklahoma and Texas, where the combined levies are 3.3 per cent, 3.4 per cent, 3.5 per cent and 3.5 per cent, respectively."

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Patches of Blue as Big as a Dutchman's Breeches?

Whether it be the upsurging insistence of buying too-long-delayed, under the restrictions of bank holidays, that is leading to a late spring revival of retail trade or threats of inflation which would bring higher prices before long or confidence regained and willingness to spend for more than the absolutely necessary things, the facts are that there are cheering signs on the business horizon.

Energy production, properly revered as a satisfactory telltale, continues its upward swing, showing a gap of but 4.5 per cent between the figures for a week ago this year as compared with 1932, the smallest discrepancy found since late in 1931. Carloadings rose 4 per cent in the latest figures available; an approach to the levels of the ill-fated boomlet of September. Retail buying is reported to show encouraging strength. Commodity prices have undergone a remarkable recovery, reaching by rapid steps the approximate high point for the year. Security markets are beginning to show some evidences of greater stability. General indexes have returned to about the levels of last August. Money continues to return from circulation in large volumes, indicating further cessation of hoarding.

Influences of the week: President Roosevelt's backing of Muscle Shoals achieves presentation to Congress — not encouraging. Sharp drop in railroad earnings leads to probability of early action on tentative administration plans for reorganizations — badly needed. Invitations to world parley and preliminary discussions issued — end of our economic isolation vital to world recovery. Success of 30-hour week law held unlikely — if for no other reason because of its probable unconstitutionality — for another, it would but emphasize the advantage of the foreign producer who can produce at lower costs.

On the whole, an encouraging week. Perhaps the movement will gain enough momentum to carry through the summer and into a sustainable fall revival. Not an improbable prospect.

Mercury Turbines May Yield to Aluminum Bromide

Offering anhydrous aluminum bromide as a fluid superior to mercury for binary-cycle power generation, and the only alternative to the use of that metal, H. Barjot, writing in *Le Genie Civil,* offers an indication of how it could be adopted to advantage.

Anhydrous aluminum bromide has the formula Al_2Br_6. Its melting point is 200 deg. F. and boiling point 500 deg. Advantages recognized are: Nonpoisonous vapor, ability to moisten iron, visibility of escaping vapor, vapor density double that of mercury (allowing low rotary speeds of turbine), lower cost and unlimited reserves of the basic constituents. Dr. Barjot states that only about 22 lb. of the substance would be required per kilowatt of capacity, at a cost of $2.

Because of the great affinity of this substance for water a special type of condenser boiler with a "triple-wall" device would be required, the purpose of which would be to prevent any possibility of contact between the condensing aluminum bromide and the contiguous boiling water, such as might occur through an accidental break. The diagrammatic hook-up would be generally similar to that of the mercury-steam cycle.

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Free Ranges by Ontario Hydro

Announcement has been made by the Ontario Hydro-Electric Power Commission of its intention to install electric water heaters free of charge in homes of the province where facilities now exist. Due to the slackening of industry, there is on hand a supply of power far above the demand and the commission feels that the funds spent in free installation of electric water heaters will be justified by the additional revenue it will receive through increased use of electric power.

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X-Ray Inspection Due for Hoover Dam Welds

By all odds the largest industrial X-ray inspection job to have been undertaken will be effected in the examination of the steel welds on the penstocks for Hoover Dam. Every inch of steel for a total length of 75 miles will be subjected to careful analysis. A special shock-proof apparatus rated at 300,000 volts has been developed for the job by engineers of the General Electric X-Ray Corporation. The apparatus, built in Chicago, is now on location at the dam and will soon be in use.

Complete safety in dealing with such high voltages, space limitations and necessarily easy portability made the development of the apparatus difficult. When the penstock contract for the dam was awarded to the Babcock & Wilcox Company of Barberton, Ohio, it was with the provision that all fusion welds pass X-ray inspection. The penstock sections range from 8½ to 30 ft. in diameter and the thickness of the steel is 3 in. in many places. These giant sections will be welded circumferentially and longitudinally, a job calling for a minimum of 159,000 separate X-ray exposures, involving the use of more than 24,000,000 square inches of X-ray film.

To cope with this unusual problem and keep up with the planned construction schedule X-ray apparatus of a new type was necessary. Rated at 300,000 volts and 10 milliamperes for continuous operation, it is capable of producing radiographs of welded steel plate of 4-in. thickness.

Lehman Utility Program Blocked in Legislature

Ignoring urgent messages from Governor Lehman in the closing session, the New York Legislature this week scrapped two important items in the public utility regulation program advocated by the Governor (ELECTRICAL WORLD, April 1, page 406). One would have fixed on the utility companies the cost of rate cases, a procedure now followed by the insurance and banking department in investigations. At present the cost is levied on the state and it was estimated that $750,000 could be saved in state expenditure were the charges shifted to the utilities.

The other measure, permitting municipalities to own, operate and purchase any public utility service, either inside or outside their territorial limits, was supported by Frank P. Walsh, chairman of the Power Authority; Delos M. Cosgrove, a trustee, and by the mayors of several cities in the northern part of the state, but aroused considerable agitation in public utility circles.

Two bills approved

Two bills in the Governor's program did pass both state Senate and Assembly, one providing that no public utility without consent of the Public Service Commission shall loan moneys, stocks, bonds, notes or other evidences of indebtedness to any corporation, company, association, partnership or individual, owning or holding directly or indirectly any stock of such utility, the other empowering any municipal corporation to appear as party to any suit or proceeding before the commission or any court, where rates, service, or other matters at interest are under consideration.

Coming Meetings

Northwest Electric Light & Power Association, Engineering Section, Portland, Ore. April 20-22. Berkeley Snow, 707 Spalding Building, Portland, Ore.

Missouri Association of Public Utilities—St. Louis, Mo., April 27-28. N. R. Beagle, 101 West High Street, Jefferson City, Mo.

American Institute of Electrical Engineers—District meeting, Schenectady, N. Y., May 10-12. Summer convention, Chicago, Ill., June 26-30. H. H. Henline, 33 West 39th St., New York.

Electrochemical Society—Montreal, Que., May 11-13. Colin G. Fink, Columbia University, New York.

National Electrical Manufacturers Association—Hot Springs, Va., May 22-26. A. W. Berresford, 570 Lexington Ave., New York.

National Fire Protection Association—Milwaukee, Wis., May 29-June 1. A. R. Small, 109 Leonard St., New York.

Edison Electric Institute—Chicago, Ill., June 5-8. B. F. Weadock, 420 Lexington Ave., New York.

Canadian Electrical Association—Lucerne-in-Quebec, June 14-16. B. C. Fairchild, Power Building, Montreal, Que.

American Society of Mechanical Engineers—Chicago, Ill., June 26-30. C. W. Rice, 29 West 39th St., New York.

American Society for Testing Materials—Chicago, Ill., June 26-30. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Engineers' Day. Century of Progress Exposition—Chicago, Ill., June 28. G. E. Pfisterer, 308 W. Washington St., Chicago.

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A.I.E.E. District Meeting to Be Held in Schenectady

May 10-13, Wednesday to Saturday, the ninth annual meeting of the northeastern district of the American Institute of Electrical Engineers will be held in Schenectady.

First day—Program of selected subjects, to cover electrical characteristics of impregnated cable papers, loss characteristics of silicon steel at 60 cycles with d.c. excitation, variable speed constant voltage d.c. machinery, design of transformers in resistance welding machines, a study of the ways in which American colleges are adapting themselves to changed conditions in industry, and radio aids to air navigation.

Air conditioning

Second day—Air conditioning, with papers on the electrical equipment used, the energy requirements of various types of equipment, railroad air conditioning, and aerodynamic aspects of the general subject.

Reactive power

Third day—Student technical session and study of reactive power. The latter to include discussions by V. G. Smith of the University of Toronto, W. V. Lyon of Massachusetts Institute of Technology, C. L. Fortescue of Westinghouse, J. Allen Johnson of Buffalo, Niagara & Eastern Power Corporation and W. H. Pratt of the General Electric Company.

Engineers Prepare for E.E.I. Régime

SECURE in the knowledge of an eventual but limited resurrection in the Edison Electric Institute, the Engineering National Section, N.E.L.A., expired more or less contentedly in Detroit last week. This, the demise of the last section granted short reprieve by the liquidating committee, completed the process of dissolution of the National Electric Light Association. Although he disclaimed any such implication, but in spite of disclaimer was accepted as a prophet by his hearers, Alex Dow gave to the assembled engineers his interpretation of the new dispensation.

Dow explains the new order

Referring to the N.E.L.A., Mr. Dow said that committees had overexpanded in the old organization and that in general there was too much specialization of committe work which the executives did not understand. He stated two objectives aimed at by the board of trustees of the new institute in its consideration of future committee work. First of these will be that committees will have the capacity of authoritative pronouncement through the inclusion of responsible executives in their membership. The second is that a close coordination of committee activities will be brought about by interlocking membership. It was the intention of the institute, he said, that committee and other meetings should be smaller and more business-like and that these meetings shall be devoted exclusively to consideration of their problems by responsible people in the industry. Particularly referring to the engineers in the concluding portion of his talk, Mr. Dow remarked that electric utility financing is going to be very difficult for the next two or three years and it was up to the engineers to make the best possible use of the investment in plant and system capacity now existing.

New committee chairmen

Making the rounds of the various committee meetings, A. H. Kehoe, chairman of the expiring section, told each group in general terms what might be expected in regard to their work in the new régime. He said that committees will be constituted of individual members of the institute who will come from each member company in proportion to that company's dues. For some time to come there will probably be less than the 2,000 individual membership set up as the total for the institute. There will be three engineering committees. The transmission and distribution committee will have Mark Eldredge for chairman and will include the activities of the former overhead, underground and foreign systems co-ordination committees. The power generation committee, of which A. D. Bailey will be chairman, will include prime movers and hydraulic power. The electrical equipment committee, with J. Allen Johnson for chairman, will take up the work of the former apparatus, meter and power systems engineering committees. The operating committee of the institute will approve the personnel and operation of committees and will also approve the subjects they undertake for study. Mr. Kehoe emphasized to the assembled group that the object of the present meeting was to liquidate their activities, terminating such as could be so treated and putting others into shape for consideration as to their continuance by the operating committee of the institute.

From discussions at the various committee meetings the conclusion is inescapable that the three engineering committees of the institute will have a huge amount of work on their hands if they undertake to carry on all of the activities and projects bequeathed by the N.E.L.A. organization. To mention only a few: The overhead systems committee was deep in the study of distribution design, for which a subcommittee had been formed last year and which to date has resulted in the accumulation of a large body of data on distribution costs from cities of three population classes. It was occupied also with a study of distribution transformer operation and embroiled deeply in a consideration of the subject so very live at present, ground interconnections of primary and secondary neutrals. Distribution costs, cable operation and a.c. network operation are among the legacies left by the underground systems committee. The power systems engineering committee included in its last will and testament such subjects as system and service protection, load and revenue forecasting, system grounding, system losses, load area development, service continuity and study of system investments. Saving its successor some work, the electrical apparatus committee approved the report of the joint committee on ratings for oil circuit breakers before it died, but it handed on several torches in the shape of studies on insulation co-ordination, utilization of energy on customers' premises, which includes such argumentative matters as motor-starting current, lighting flicker, etc., as well as the consideration of protection against oil fire hazards. The prime movers committee approved several reports and had active discussions on oil fires, operating performance of prime movers and standardization of fittings. The meetings were well attended and bore wit-

ness to the fact that the technical work under way is highly important and should not be discontinued.

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Alabama Power Reports Decreased Earnings in 1932

(Year ended December 31)

Earnings		
Gross earnings	$15,583,840	12.2% below 1931
Net earnings	$8,084,090	11.0% below 1931
Operating ratio	48	in 1931, 49
Depreciation allowance	$936,000	6.1% of gross earnings 0.5% of plant investment
Times prior charges earned	1.9	in 1931, 2.2
Net balance per share of common	$0.29	in 1931, $0.61
		Compared with 1931, per Cent
Output		
Energy sales, kw.-hr.	1,092,968,729	—8.4
Balance Sheet		
Total assets	$193,625,419	+0.9
Funded debt	$96,928,200	no change
Capitalization	$181,641,904	+0.9
Total surpluses plus reserves	$9,047,354	+3.0
Ratio current assets to current liabilities	2.8	in 1931, 2.1

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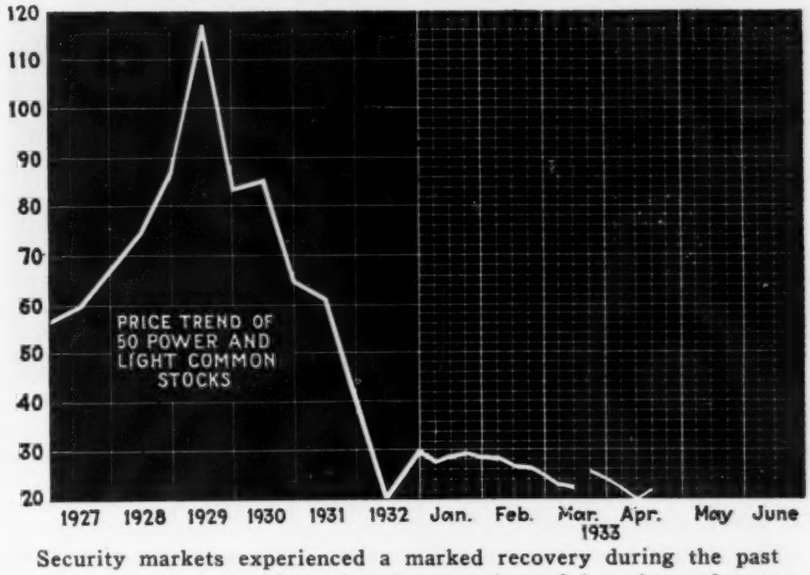
Philadelphia Electric Cuts Operating Costs

(Year Ended Dec. 31, 1932)

Earnings		
Gross earnings	$62,492,736	4.8% below 1931
Net earnings	$29,679,930	0.9% below 1931
Operating ratio	53	in 1931, 54
Depreciation allowance	$5,206,096	8.3% of gross earnings 1.4% of plant investment
Times prior charges earned	3.9	in 1931, Same
Net balance per share of common	$1.99	in 1931, $1.92
Dividends declared on common	$1.81	
		Compared with 1931 Per Cent
Output		
Sales of electricity, kw.-hr.	2,500,262,372	—6.5
Average use per customer, kw.-hr.	4,006	in 1931, 4,199
Balance Sheet		
Total assets	$413,921,115	+0.9
Funded debt	$167,620,500	—0.5
Capitalization	$330,344,535	Change neg'ble
Total surpluses plus reserves	$52,211,242	+10.9
Ratio current assets to current liabilities	2.6	in 1931, 2.8

Utility Stocks Share in Advance



Security markets experienced a marked recovery during the past week. Utility issues, following the general trend, in a sharp advance carried the "Electrical World" index up to 21.8, as compared with 20.3 in the preceding week.

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New York Commission Bans Competing Private Plant

Holding that the Spingler Electric Corporation could not generate and supply electric energy to its tenants and customers at a lower rate than could New York Edison Company, the Public Service Commission has denied a petition of the Spingler company for permission to construct an electric plant and exercise a franchise for the furnishing of electricity in a limited area of about four blocks in New York City. "It has not been shown that public convenience and necessity require granting of this petition or that it would result in public benefit," the commission ruled. "Moreover, the granting thereof would be detrimental to the public interest, provide less continuity and reliability of service than that now available and set an unwise precedent which might lead to increased rates to other consumers."

The Spingler-Van Buren Estate, a holding corporation, owns most of the real estate in a four-block territory and now purchases current wholesale from the New York Edison Company and submeters it to its tenants through the electric corporation. The purpose of the corporation, the commission stated, was a desire to protect the profit now gained through submetering.

Permission to generate and distribute energy was sought last year following submetering hearings.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Kansas City Power & Light (Year ended February 28)					
Gross earnings	$14,717,047	$14,676,507	0.3	62	60
Net earnings	5,652,766	5,948,902	— 4.8	..	..
Net balance*	3,823,810	4,409,959	—13.3	..	..
Puget Sound Power & Light (Year ended February 28)					
Gross earnings	13,212,799	15,448,027	—14.5	61	61
Net earnings	5,158,560	5,958,073	—13.4	..	..
Net balance	160,882	896,348	—81.7	..	..
Virginia Electric & Power (Year ended February 28)					
Gross earnings	15,140,553	16,806,017	— 9.9	64	66
Net earnings	5,461,197	5,696,575	— 4.1	..	..
Net balance	2,382,972	2,713,393	—12.2	..	..
Northern States Power (Year ended January 31)					
Gross earnings	32,087,761	34,011,572	— 5.6	60	56
Net earnings	12,832,837	14,829,908	—13.5	..	..
Net balance	1,876,368	3,998,172	—53.1	..	..
Holding Companies					
American Water Works & Electric and Subsidiaries (Year ended February 28)					
Gross earnings	$42,857,408	$49,025 129	—12.6	56	55
Net balance	2,050,361	4,960,047	—58.3	..	..

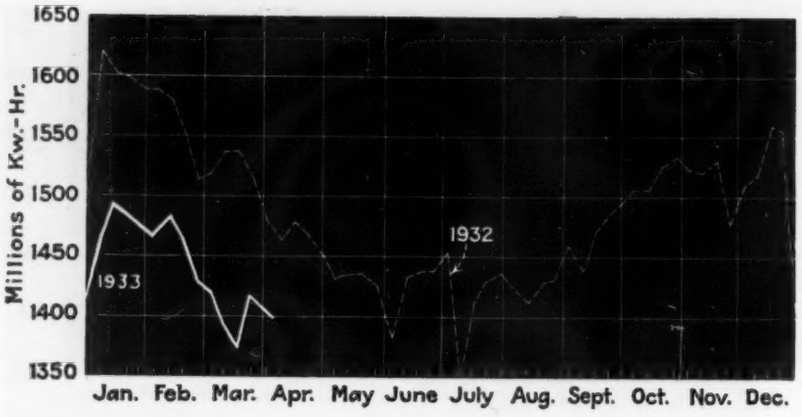
Holding Companies

	1933	1932	Per Cent Increase	Operating Ratio 1933	Operating Ratio 1932
Commonwealth & Southern and Subsidiaries (Year ended February 28)					
Gross earnings	$111,921,331	128,313,161	—12.8	54	53
Net balance	2,480,201	12,523,615	—80.0	..	..
Public Service of New Jersey and Subsidiaries (Year ended February 28)					
Gross earnings	123,055,010	135,808,427	— 9.4	66	67
Net balance*	27,089,296	30,673,652	—11.7	..	..
Philadelphia Company (Year ended January 31)					
Gross earnings	48,548,935	56,447,581	—13.9	65	62
Net balance	5,013,989	9,796,194	—48.9	..	..

* Available for all dividends.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes depreciation, maintenance, operating, etc. Net balance — Balance available from income for common stock dividends.

Industrial Energy Use Grows



Employment reports of the past few weeks are being supported by returns on electrical energy output. During the week ended April 8 the total production of electric light and power plants, as announced by the Edison Electric Institute, was 1,399,367,000 kw.-hr., or only 4.5 per cent less than in the corresponding week a year ago. Thus current operations make another step toward equality with those of 1932.

The decrease from the preceding week is almost negligible, and the net decline since the beginning of March is more than accounted for by the normal reduction in the lighting load. It points toward an actual and quite material increase in industrial activity, especially in view of the favorable changes in the Eastern and Central industrial areas.

Weekly Output, Millions of Kw.-Hr.

Week ended	1933	1932	1931	1930
April 8.....	1,399	1,465	1,647	1,715
April 1.....	1,402	1,480	1,680	1,708
March 25....	1,410	1,515	1,689	1,723
March 18....	1,375	1,538	1,682	1,722
March 11....	1,391	1,538	1,676	1,736

Per Cent Change from Previous Year

Region	Week Ended Apr. 8	Apr. 1	Mar. 25
Atlantic Seaboard.....	—2.7	—4.6	— 4.3
New England alone..	—3.8	—7.2	— 7.6
Central industrial.....	—5.7	—8.1	—10.9
Pacific Coast.....	—6.8	—5.7	— 4.1
United States.....	—4.5	—5.3	— 6.9

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Beauharnois Committee Favors Reorganization

Agreeing to the reorganization plan presented by Montreal Light, Heat & Power Consolidated the bondholders' protective committee has recommended to the holders of the 30-year 6 per cent collateral trust sinking fund bonds of the Beauharnois Power Corporation that the utility's offer be accepted (ELECTRICAL WORLD, April 8, page 437).

The plan, on which the hondholders' committee has placed its stamp of approval, provides for a new issue of collateral trust bonds to be given to present holders in the ratio of $120 principal amount for each $100 presently held, on which interest at 5 per cent would commence on April 1, 1938, in Canadian funds; an issue of first mortgage bonds to be underwritten by Montreal Power on the Beauharnois Light, Heat & Power Company, authorized to a total of $75,000,000, of which $40,000,000 would be issued to provide for advances by the banks and obligations to the federal and Quebec governments, and leaving $1,000,000 in the treasury. A reduction in the common stock outstanding would be accomplished by exchanging one new share of common for each ten shares now held.

Operating company to finance

The Beauharnois Light, Heat & Power Company, subsidiary to the corporation and the operating company, has $40,000,000 of ten-year first mortgage bonds issued and outstanding; and 40,000 shares of common stock with a par value of $100 outstanding. These shares form the collateral behind the issue which is now in the hands of the public.

The indebtedness of the operating company to the holding company is to be canceled. The operating company will make an issue of $36,000,000 of second mortgage bonds, bearing the same rate of interest as the collateral trust bonds, and the dates of interest payments will also correspond.

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Would Put Energy Tax on Utilities

Two measures designed to relieve consumers of paying the federal 3 per cent tax on electrical energy were introduced in the House of Representatives this week by Representative Condon, Democrat, of Rhode Island. The first bill would shift the tax to power companies. The second, which would be pressed only in case the first failed, would do away with the tax on service charges, leaving only a tax on the power consumed.

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China's Power Plants Now Total 893,645 Kw.

Electrical development in China is continuing in spite of the misunderstandings and virtual warfare which has torn that country for some time. According to the report of the Chinese National Committee, prepared for submission to the World Power Conference this year, the total increase in generating capacity in the past three years was more than 6 per cent.

There are 665 electric power plants in China, with an aggregate generating capacity of 893,645 kw. Of these establishments 519 are central stations and 146 are industrial plants. The utilities have 78 per cent of the total number of plants and 62.5 per cent of the generating capacity.

According to the Chinese World Power Conference committee, the average investment per kilowatt of capacity is $600, divided as: Generation equipment, 55 per cent; transmission and distribution equipment, 30 per cent; other tangible property, 15 per cent.

Although China has been reputed to be quite rich in water-power resources, only about 2,000 kw. in hydro-electric development has been made.

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Power Export Ban Lifted by Quebec Legislature

Hydro-electric exportation to the United States was authorized by the Province of Quebec last week, when the legislative assembly adopted a bill lifting a six-year-old ban. The measure is expected to yield the province approximately $600,000 per annum, with 300,000 hp. export, on which a royalty of $2 per unit will be charged. In explaining the legislation Premier L. A. Taschereau revealed in the provincial legislature that one of the chief reasons for it is to "deal a deathblow to the St. Lawrence waterways development project." "The development of the St. Lawrence waterways will be a very expensive matter," he said. "It is designed to give the United States about 1,000,000 hp. If we say to the United States: 'Here is 250,000 or 300,000 hp., why go ahead with the St. Lawrence project,' will that not be a telling argument? New York and the New England states are mainly interested as regards electricity and will benefit. If we tell them they will not have to pay one cent for development costs, I am sure they will be no longer interested in that project."

Inspectors Back War on Unsafe Merchandise

"By the purchase of unapproved, bargain counter variety of electrical merchandise, users of electricity, unknown to themselves, undertake an element of risk that frequently nullifies the carefully safeguarded wiring installations in their homes," declared Paul Ferneding, chief electrical inspector for the Borough of Manhattan, New York, speaking before a committee of the Electric Association of New York last week. Continuing, he said: "This purchasing practice interrupts electric service and creates potential fire and accident hazards. Moreover, the uninformed usually lay the trouble resulting from these improperly made products to electric service.

"In the past few years, with business conditions bad, numerous dealers in electrical merchandise, as well as manufacturers, have turned to cheap, dangerous material as a means of stimulating business. We are informed that a large portion of the fire losses of known electrical origin are attributed to fires started beyond permanent electrical installations.

Local chapter to act

"The New York Chapter of the International Association of Electrical Inspectors feels it is time for this untenable condition to be eliminated by adopting a system of public education and publicity addressed to the elimination of unapproved electrical goods among retail stores handling electrical devices and materials throughout the city of New York and vicinity" (ELECTRICAL WORLD, April 1, page 408).

To eliminate the situation which he outlined, Mr. Ferneding proposed a plan which would embody a sponsoring committee representing the city of New York, the New York board and utilities, a contact and inspection subcommittee to interview dealers in electrical devices and materials and instruct them in the proper approach, and two other subcommittees to arrange speeches before public gatherings and handle publicity, respectively.

To enable distinguishing approved safe material, he proposed:

> The standards of Underwriters' Laboratories which, of course, are minimum requirements, are now the bases of our approval of electrical merchandise. Merchandise which has not received the approval of Underwriters' Laboratories, but which complies with the minimum requirements of such standards or which exceeds these requirements, should also be acceptable if compliance with such standards is certified to by some other duly recognized organization which is equipped with proper facilities for examining and testing such merchandise and with facilities for following up this material in the field.

One form of support asked of the New York Electrical Association is to:

> Circularize members asking them to cooperate by selling only approved merchandise, instruct their salesmen to emphasize approved devices, advertise only approved devices and state this fact in their advertising; discuss the need for buying only approved devices with home economic classes, etc.

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Washington's New Law Would Tax Utilities 3 per Cent

Following passage by the Washington state Legislature of a tax measure placing a 3 per cent impost upon electrical and other utility gross revenues, Gov. Clarence D. Martin modified the bill in signing it by striking out the clause which passed the levy along to the customer. As matters now stand customers of either privately or publicly owned power projects are free of the tax, which must be borne by the supplying agency. City plants protest. Electric light and power companies are in a quandary.

Seattle and Tacoma municipal plants plan concerted action. Seattle's City Council maintains that the state is barred by constitutional provisions from taxing publicly owned utilities which are operated for service and not for profit. Superintendent J. D. Ross of the Seattle plant sees the only alternative to breaking the law as a general increase in rates. "City Light would have to pay about $180,000 a year," said Mr. Ross.

Public utility companies are studying the effect of the law upon them should it become effective, as now specified, on August 1. "The 3 per cent tax on gross revenues in the case of the Puget Sound Power & Light Company," said Frank McLaughlin, president, "will approximate $350,000 a year. At a time when we are not paying dividends to our stockholders it puts a serious burden upon the company and its customers. The corporation has no other source of revenue than the sale of electrical energy to its patrons, and whatever burdens are imposed must eventually be borne by them."

New rate base allowed

Further complications arise in that the new Board of Public Works, which meets this month, is given broad powers by recent legislation to use present low replacement costs in fixing the valuation of public utility properties as a basis for rate making. The first test of the new laws will come when the Board of Public Works hears the appeal of the city of Seattle from the decision of the old board giving the Seattle Gas Company the privilege of passing along the municipal 3 per cent tax, ordered last year, to consumers. The board has announced its intention to go into the whole rate structure of the gas company.

Major New Construction This Week

Heavy-duty motors, controls, transformers, pumping machinery, compressors, etc., will be installed at Wellsville, N.Y., by Sawyer Refining Company, Bolivar, N. Y. Cost over $200,000.

General electrical equipment needed for French Creek Valley Brewing Company, Meadville, Pa. Cost about $250,000.

Equipment bids soon to be asked by Geneseo, Ill., for $150,000 city-owned electric light and power plant.

General electrical equipment will be installed by Standard Brewing Company, Scranton, Pa. Cost over $100,000.

Motors, pumps, compressors, etc., required at Houston, Tex. Plant of Shell Petroleum Corporation. Estimated cost over $500,000.

General electrical equipment will be installed in plant of Southwestern Brewing Company, Tucson, Ariz. Bids soon asked. Cost about $400,000.

North Chicago, Ill., is arranging fund of $425,000 for city-owned electric light and power plant. Bids to be asked soon.

General electrical equipment for plant of Flock Brewing Company, Williamsport, Pa. Cost about $100,000.

Staten Island Refusal Explained

Approval was announced last week by the New York Public Service Commission of the report of W. T. Wilkinson, examiner, recommending denial of the amended petition of the Staten Island Edison Corporation to issue $5,761,000 in 30-year mortgage bonds and to apply the proceeds to payment at maturity, on June 14 next, of refunding and improvement 6 per cent bonds, dated June 15 last (ELECTRICAL WORLD, April 8, page 440). "The record does not warrant a change in the commission's original findings," the report asserts. "The record on rehearing and the amendatory petition has merely enlarged the detail of the transactions involved and has substantiated the conclusions. Of the manifest purpose of the note issue there can be little doubt. The issue was, in fact, for the express purpose of advancing funds to the holding company; an 'up-stream' loan, in fact. The power to improve the Staten Island's credit lies with the holding company, recipient of the advance, through the sale of the securities heretofore proposed for substitution." Staten Island Edison is a part of the Associated Gas & Electric system.

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New York Metal Prices

	April 4, 1933 Cents per Pound	April 11, 1933 Cents per Pound
Copper, electrolytic	5.00	5.25
Lead, Am. S. & R. price	3.00	3.25
Antimony	5.85	5.70
Nickel ingot	35.00	35.00
Zinc, spot	3.35	3.45
Tin, Straits	24.70	25.50
Aluminum, 99 per cent.	23.30	23.30

Defer Wisconsin Merchandising Bill

After a hearing which brought to Madison the largest delegation which has appeared at this session of the Wisconsin Legislature on any single bill, the assembly committee by a vote of nine to two voted to indefinitely postpone the Cavanaugh bill forbidding the utility companies to engage in merchandising. Utility representatives presented petitions requesting defeat of the bill which they claimed were signed by more than 140,000 large and small users of electric and gas appliances. Arrayed against them were the small dealers and their representatives who charged that unless such a bill was passed independent retailers would be forced out of business.

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Westinghouse Refrigerator Sales

Refrigerator sales by the Westinghouse Electric & Manufacturing Company in the first quarter of 1933 were more than twice those for the same period of 1932. It is reported that this company is operating its refrigeration production departments 24 hours a day, and that the best year for electric refrigeration so far encountered is anticipated. The greatest activity has been among the larger models selling to the public for well over $200. "With the exception of last June, when distributors bought heavily because of the impending tax, March, 1933, has been our biggest month since we entered the business," says R. C. Cosgrove, manager of the company's refrigeration division.

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No Municipal Plant for Trenton, Mo.

Surrounded by cities with municipal electric light and power plants, Trenton, Mo., has decided against undertaking such a venture. At an election last week, to authorize the issuance of an enabling bond issue, voters defeated the proposal by approximately two to one. Virtually every qualified citizen went to the polls. Trenton is served by the Missouri Public Service Company.

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Central West Plans Refunding

Management of the Central West Public Service Company has prepared a plan of adjustment and refunding in an effort to prevent any need for the institution of foreclosure proceedings by holders of its first lien collateral bonds and has invited all holders of its securities to join in the move by depositing their securities. The plan is hoped to effect extension of maturity of $2,800,000 first lien collateral 5 per cent bonds, series C, due December 15, 1933, to June 15, 1948; issuance of interest scrip in exchange for at least one coupon on all the first lien bonds, series A, B and C; conversion of unsecured funded debt into a preferred stock; issuance without cash payment, to holders of first lien collateral bonds of voting trust certificates representing not less than 51 per cent of the new class B stock; issuance, without cash payment, to holders of present notes and debentures of voting trust certificates representing not less than 26 per cent of the new class B stock of the reorganized company; conversion of present cumulative $100 par value preferred stock, series A and B, into non-cumulative class A stock; issuance to holders of each two shares of present class A stock of a voting trust certificate representing one share of new class B stock and surrender of the present class B stock.

If the present craze for ruthless economy, which is affecting trade, is substituted by a moderate program of prudent expenditure, the present year should be one of achievement and hope.

In its annual report the Council of the British Electrical and Allied Manufacturers' Association finds occasion to comment reprovingly upon a tendency which has achieved particularly virulent form in the United States.

Stockholder Sues Columbia Gas

Asserting that $41,816,177 had been lost to stockholders through mismanagement, waste and dissipation of funds, a stockholder of the Columbia Gas & Electric Corporation filed suit last week in federal court in Cincinnati for an accounting from directors of the company. Samuel J. Wiechelman of Covington, Ky., who filed the action as holder of 75 shares, asked the court to determine the liability of each defendant, numbering 21. Codefendants named were the Columbia Gas & Electric Corporation and the Columbia Oil & Gasoline Corporation.

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Utah Utility Buys Municipal Plant

Acquisition last month of the municipal power plant and distributing system at Kanab, Utah, by the Southern Utah Power Company has been announced, following the purchase of the property as a result of the January elections, when the citizens voted to dispose of the plant. The town has been operating the plant since 1929 under an installment plan whereby the company which sold the engines kept title to the equipment until the plant was finally paid for. Lack of sufficient revenue from the plant made monthly payments impossible and late in 1932 the Diesel company notified the town that it would be necessary to make up delinquent payments. Taxpayers voted three to one to sell the plant. After taking possession the power company put into effect lower rates.

Associated Allows for Write-Downs

Anticipating the possible desirability of writing down certain investments at later dates, Associated Gas & Electric Corporation, according to its preliminary report for 1932, has provided out of capital surplus a reserve for contingencies of $168,000,000. The report states: "The reserve will not be applied to a write-down of investments, except consolidated statements, until business conditions become more stabilized and the proper amount of write-down, if any, can be more accurately determined. . . . It is the intention that corresponding changes be made in the books of other companies in the Associated system as soon as the plans of the management are completed."

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New York Edison Part Time

Following the assumption of jurisdiction over labor troubles in the Brooklyn Edison case by the New York Public Service Commission (ELECTRICAL WORLD, April 1, page 403) other companies affiliated with Consolidated Gas of New York have adjusted working hours. It is announced that 900 men of the electrical and mechanical construction departments of New York Edison Company and United Electric Light & Power have been put on a five-day week. Officials say this step is taken in the hope that it will enable the companies to avoid the necessity of having to reduce the number of men now employed in these departments.

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Clarion River Purchase Approved

Purchase of a controlling interest in the common and 6 per cent participating preferred stocks of the Clarion River Power Company by the Pennsylvania Electric Company has been approved by the Pennsylvania Public Service Commission. Acquisition of the Clarion River company by the Pennsylvania Electric has been under attack by both the Pennsylvania commission and the Federal Power Commission (ELECTRICAL WORLD, September 10, page 324, and November 19, page 676). The commission in announcing its approval last week, stated the purpose of the purchase is to give the Pennsylvania Electric control of its source of electricity from the Clarion River company.

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Kansas Rate Cuts Approved

The Kansas Corporation Commission has approved the reduced rate schedules of five public utility companies, it was announced by the commission. The schedules approved include those filed by the United Power & Light Corporation, Kansas Gas & Electric Company and three telephone companies.

Some Probable Changes in National Electrical Code

Some of the recommendations for changes in the National Electrical Code recently made by the electrical committee of the National Fire Protection Association have been made public by A. R. Small, chairman of the committee. A complete list will not be available until the changes proposed by the article committees have been worked over to conform with the views expressed at the recent meeting of the committees. These will be submitted about the last week in May for letter ballot of the members, and the results formally submitted for approval of the N.F.P.A. board of directors at the end of June. Then the changes will have to go through the procedure of receiving the approval of the American Standards Association, which will probably take until September (ELECTRICAL WORLD, April 1, page 408).

Service rule amendments

Regarding services and service equipment (not over 600 volts) covered in Article IV. The following committee action was taken:

Electrical metallic tubing was accepted for service runs on buildings (408 e) and for service entrances (404 g). Bare neutral service conductors are recognized (404 e) in electrical metallic tubing and in service entrance cable and its use extended to multiphase systems. Up to four sets of service equipment at service without meters are now permitted (405 b 1). The requirement (405 b 2) for an additional fuse or circuit breaker ahead of grouped branch circuit circuit breakers has been eliminated. High-impedance measuring and control apparatus has been permitted ahead of service equipment (405 h 4). The limitation for meters ahead of service equipment (405 i 3) has been raised to 100 amp. and also authorized ahead of service equipment where up to four meters are allowed in service (405 b 1).

Considering wiring methods covered by Article V, the voltage limit for non-metallic sheathed cable (507 a), as well as of electrical metallic tubing (508 h) has been extended to 600 volts between conductors, and the permissible size of the conductors in the metallic tubing increased from No. 6 to No. 4. Section 508 i has been amended to clarify the locations in which metallic tubing may be used, while an entirely new section, 512, has been adopted on auxiliary gutters used to supplement wiring spaces at meter centers, distribution centers, etc.

Insulation changes likely

Revisions in Article VI on conductors included the following changes: The required thickness of rubber on No. 8 rubber-covered wire for up to 600 volts was raised from 3/64 to 4/64 in. (602 c). Recommendations for flame-retarding covering for rubber-covered wires type R were adopted (602 d). The committee went on record (609 e) as refusing to recognize a No. 20 flexible cord (except A T and C T). A new table of demand factors for ranges was adopted (613 d 18). Section 613 e applying to common neutrals for interior wiring feeders has been amended to permit the neutral size to be based on the unbalanced load.

In Article VII, section 703 p, the number of wires permitted in a cabinet or in isolated sections thereof was limited to 80 branch circuit wires to reduce heating.

Permission to interpose a service switch box, or house conduit, in the grounding circuit of service conduit or cable, under certain conditions, was removed (904 c). The existing grounding requirements in section 907 e and h have been amended to permit a common grounding conductor and electrode where the system is grounded elsewhere in at least two places. This will require a total of three grounds for common grounding. Cast-iron ground clamps have been accepted, but sheet-metal straps have been prohibited for wiring system grounds. Interconnection of lightning arrester grounding conductors and the grounded conductors of secondary systems has been permitted (909 k) provided the secondary has elsewhere a grounding connection to a continuous metallic underground water piping system in addition to the direct grounding connection in the arrester.

So far as panelboards outside utility systems or isolated plants are concerned, section 1303 h now limits the circuit capacity to no more than 40 circuits where there is one fuse per circuit and no more than 20 circuits where there are two fuses per circuit.

A minority report by W. C. Wagner, calling attention to the desire of the electric light and power group to have the code regulations in Article L so modified as not to apply to properties which are under the sole control of utilities was accepted in general, and fine print notes were inserted in several sections to carry out this thought. The proposed amendment to 5007a requiring certain transformer vaults to have double exits was rejected by the electrical committee.

As a result of the progress report on bare neutrals for interior wiring system, action was taken to recommend that inspection authorities give favorable consideration to trial installations thereof in order to obtain further experimental data.

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Allis-Chalmers Orders

Unfilled orders of Allis-Chalmers Company at the end of March amounted to $4,501,000 compared with $4,371,000 at the end of February, $4,831,000 at the end of January and $5,442,000 on December 31, 1932. The last payment of $4,500,000 for equipment sold by Allis-Chalmers to the Soviet government through the Amtorg Trading Corporation has been paid in full, the company states. The contract with the Soviets was mainly for tractors.

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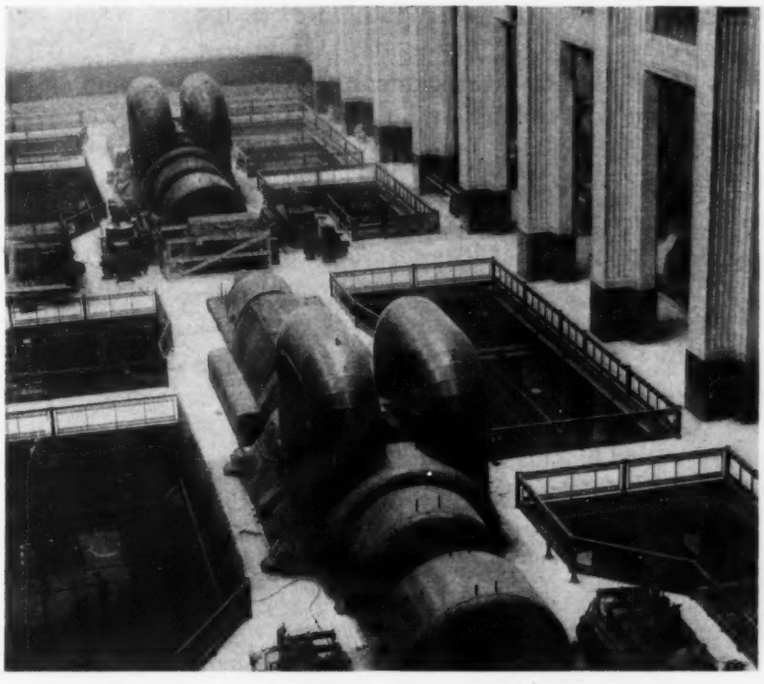
England's Largest Station Nears Completion



With engineers confidently looking forward to its completion early in the latter half of this year, work on the Battersea station of the London (England) Power Company is progressing well. Three 80,000-kw. turbo-alternators are in place, the superstructure has been completed and the installation of electrical and mechanical equipment is being speeded up. Final planned capacity 1,000,000 kw.

EDITORIALS

L.W.W.MORROW
Editor

Dam the rivers for prosperity

A RECOMMENDATION for the Tennessee development has reached Congress from President Roosevelt. It is a magnificent conception, but we question its economic merit and its practical aspects as an aid to the return of prosperity. The government has already sunk some $150,000,000 in Muscle Shoals, the next proposal is to put some $50,000,000 in Cove Creek, and the complete development of the Tennessee River for power and navigation will require an additional $248,000,000. Add to this more than $600,000,000 for the development of tributaries and the building of auxiliary steam plants and the grand total is approximately $1,000,000,000. According to the army engineers, this complete project will produce about 3,000,000 kw. of power at 50 per cent load factor at a station cost of about 4.3 mills per kilowatt-hour. This is a unit investment cost of more than $340 per kilowatt if costs are charged to power to make the project self-supporting. To these costs must be added the cost of proposed transmission lines.

This is the project that it is proposed to start. It is located in the heart of enormous coal fields, where stations may be built for burning fuel at from $70 to $80 per kilowatt to produce energy at a cost of about 4 mills per kilowatt-hour. It is in an area where already the capacity of station and transmission line installations are far in excess of the available loads and where every inducement of privately owned utilities to develop industries has been given for years and yet little has been accomplished. It is in an area where hardwood timber grows and it takes many years to grow a tree. It is in an area where unemployed miners will be far in excess of foresters and station operators if subsidized power is sold. It is in an area where navigation is not needed and would not be used.

Considered from every angle—power, unemployment, navigation, agriculture and reforestation—the conclusion is inescapable that the taxpayers of America will pay and pay for the enormous sums of money sunk in this project. It will turn out to be an enormously magnified Muscle Shoals—a $1,000,000,000 dream for taxpayers to maintain.

Tennessee board tells why rates are hard to slash

ON MARCH 15 Tennessee's Legislature peremptorily put the Railroad and Public Utilities Commission on the griddle by demanding within ten days a reason "why utility rates have not been reduced." Within seven days the commission filed its answer, politely but devastatingly. Now it appears the Legislature will have to take the responsibility for defying the U. S. Supreme Court and putting every utility in the state into bankruptcy. This is the result which the commission demonstrates would follow from the 25 per cent horizontal reduction relatively mildly phrased as follows in the joint resolution: "Whether or not all rates . . . may be legally reduced by at least 25 per cent of present charges."

Much has been said by utility spokesmen about the reasons why rates cannot be cut to fit the contour of a living-cost curve, but never has it been said more comprehensively, more forcefully and more convincingly than General Harvey Hannah and his fellow commissioners put it in answering their masters in the Assembly. What the politicians can learn therefrom about the utility law of the land, about the right to earn enough to pay fixed charges and economical operation, about the irrelevance of commodity price levels to electric rates and about the consequences of

wholesale bankruptcies should hold them a while. They should also learn how active the commission has been in making rate adjustments which in conjunction with voluntary reductions have brought electric rates 21 per cent lower than in 1913, whereas living costs are still 32 per cent higher than that. Maybe they will learn incidentally too how much electrical expansion under the supervision of the commission has added to the wealth and the industrial emancipation of the state. If they remain persistently blind to all this the next maneuver will undoubtedly give us—shades of William Jennings Bryan—another Scopes trial, with, however, the "fundamentals" this time on the side of rime and reason.

A reaction from the dealers

RECENTLY three hardware and implement dealers' conventions, in Washington, Oregon and Idaho, discussed at length the policy and practice of power company merchandising. In Spokane and Boise they commended the progress that is being made in developing harmony and co-operation with the utility companies. In Portland they first indorsed the anti-merchandising bill then before the Legislature, but later appointed a contact committee and expressed the desire to work the matter out to mutual advantage. Meanwhile the leading journal of these dealers in the Northwest reported the proceedings with frank justice to both sides, throwing its influence for a sensible basis of accord that would permit the power companies to help in the development of the market, with fair policies that will permit the dealers to participate profitably.

The Oregon bill now having died in committee, the electrical trade, which helped kill it, appeals to the utilities to pay their debt by more aggressive merchandising that will stimulate the retail market for domestic appliances.

The same thing has happened in other situations. Dealers have helped defeat legislation and then said: "We've done this for you. Now you help us by more active selling that will benefit us all." In short, recognition seems to be growing in spots that it is better for the power companies to be in the merchandising business, creating more market for all dealers, than out of it and doing nothing to increase popular demand—which is about what happens in any company when no results can be shown for the department by sales.

The merchandising controversy is not solved in any city by abandoning the market and with it the dealers also. The answer lies in intelligent teamwork with all dealers, to build more business that all will enjoy. And with patience and understanding it can be done.

Cost consciousness down the line

ECONOMICAL operation of a factory, power plant, power system or any large enterprise can be obtained in several ways, but it is remarkable how much better any reforms tending toward economy stick if they come from within; remarkable yet perfectly understandable. A new scheme of operating or maintenance that carries with it pride of authorship on the part of the rank and file has patently a much better chance of developing lustily than that same scheme behind a general manager's order. Besides, there is a definite limit to what one general manager can accomplish.

Yet in many cases the development of new ideas and more economical methods is prevented by a failure to develop cost consciousness among foremen and men in the ranks. It may be difficult to believe that men are being asked to economically maintain boiler houses, or any other part of the electrical system, without at the same time being told how the costs run and how the various component parts contribute toward that cost. But if any one doubts that there are such cases, let him question the men engaged in maintenance. An almost totally new viewpoint is possible on the part of those engaged in industrial processes, whether it be machine assembly or stoker repairs, when the dollars and cents of each step are realized.

Of course, there is the objection of the expense of a cost system. But experience is available that a very simple cost accounting system can be introduced, not suitable for formal report purposes, but adequate in all cases to accomplish the main aim—the making of all the personnel down the line cost conscious. The savings obtained where this has been tried are many times the cost of bringing it about.

Exposing Omissions in "Savings" Contracts for Diesels

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Subjects Covered in This Series

Retaining Existing Customers[1]
Sifting Power Prospects[2]
Scenting Flaws in Proposals for "Payment Out of Savings"[3]
Find the "No" Man First[4]
Approach to an Untouched Market[5]
When the Odds Are Against You[6]
Exposing the Omissions in "Savings" Contracts for Diesels
Yardsticks for Power Sales

[1]*Published Oct. 22, 1932;* [2]*Nov. 19, 1932;* [3]*Dec. 10, 1932;* [4]*Dec. 24, 1932;* [5]*Jan. 14, 1933;* [6]*Feb. 18, 1933.*

SUCCESS in meeting Diesel competition depends largely upon bringing forcibly to the prospect's attention those intangible and somewhat elusive, though highly essential, items that are quite generally omitted from the contract obligations of the engine manufacturer. When making comparisons between purchased power and Diesel power it is important to consider *all* of those items of cost entering into the purchase, installation and operation of the oil engine plant which are necessary to assure service equal in all respects to that supplied by the utility. Power salesmen can have no valid argument against well-designed, adequate plants economically adapted to the purchaser's needs. Their principal worry in meeting the present lively competition is in establishing this home-made power of the Diesel on an equitable and comprehensive basis for comparison with the power service the utilities have to sell.

Today engines are cheaper, labor is cheaper, fuel is cheaper, buildings and space are cheaper than they have been heretofore, and some of these items are cheaper than many believe they are likely to be in the future. Under present conditions it is possible for the engine salesman to make an appeal based on an investment set-up in which the fixed charges appear (if they appear at all) to be less than the demand charge for purchased power and in which those operating costs that are included appear to be less than the utility's corresponding energy charge. But things are not always what they seem, and the power salesman need not feel that he is licked or even stymied, because it is usually possible for him to put his finger on an assembly of items which represent an out-of-pocket cost to the purchaser, in excess of the outright commitment on the purchase contract. It is the purpose of this article to develop three methods of bringing these items to the surface of any negotiation and to compel their recognition by the purchaser, to the end that he may realize how "payment-out-of-saving" may easily become "payment-out-of-pocket."

Plant inventory a helpful tool

The first method suggested for "bringing out the facts" might be called a "plant inventory" and is based upon the use of a check list of all items that should be considered in any Diesel plant, plus any items that are essential to the particular circumstances. There is no merit in getting into a heated argument over the proper percentages to use in figuring fixed charges when the base on which such charges must be computed is entirely inadequate. The first sin of omission in the Diesel contract is the omission of a large part of the plant itself. There are still many would-be purchasers of Diesel plants who must be shown that there is far more to a Diesel plant than the engine itself. And no single-engine plant may be fairly compared with central-station service. When the average Diesel proposal omits at least one of the required engines it may be supposed that a host of other omissions are to be expected—and found.

That it pays the prospective purchaser of a Diesel to engage a competent consulting engineer is graphically shown in the accompanying schedule of investment costs as proposed by the engine company and as estimated by the consulting engineer. The engineer has here used one form of check list by which the engine proposal was compared, item for item, with an "adequate" plant. The omissions in the engine proposal stand out before the customer's eyes when so presented. In this instance the combined maximum capacity of the engines in the proposal fell short by 50 kw. of the *average* demands of the customer from actual meter records. Moreover, the engine company provided only two engines for a large load at high load factor. The consulting engineer provided three units to permit one engine to be out of service (nights only) part of the time, thereby more nearly approaching the reliability of central-station service which these engines were intended to replace. When the consulting engineer totaled his column of necessary items to make a complete plant he arrived at a figure 62.5 per cent above the figure in the engine proposal. This prospect was not impressed by arguments centered around depreciation on the "straight line" or "sinking-fund" basis, nor even in taxes and insurance, which he lumped with his whole factory overhead. He *was* impressed by the fact that the engine company had proposed to sell him a plant that was only a little more than "half there."

Check list is a convincing argument

Items shown in Table I do not cover all likely outlays for all cases because this list was drawn to cover a particular instance. The check list presented in Table II will be found to apply to many pending cases because it has been compiled out of many experiences under varying

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Table I—Manufacturer's Estimate Far Below That of Consulting Engineer

This plant had a maximum demand of 700 kw., an average demand of 650 kw. and an annual power consumption of 2,800,000 kw.-hr.

Items of Investment	Proposed By Engine Company	Recommended By Consulting Engineer
Mechanical Equipment		
Engines — units	Two, 300 kw.	Three, 350 kw.
Cost of engines, generators and exciters — f.o.b. factory	$53,000	$70,000
Handling and hauling	500	.....
Set of engine spare parts	.....	375
Fuel oil day tank	.....	130
Engine-driven air starting set	.....	390
Fuel oil transfer pumps, motors and hand starters	.....	270
Pyrometers, switches, thermocouples	.....	330
Air filters and fittings	.....	480
Water circulating pumps	.....	675
Indicators	.....	525
Centrifugal with heater tank for manual control	.....	395
Electric speed changers	.....	675
Erection of engines, generators and auxiliaries	2,292	5,000
Excavation and concrete for foundation	2,240	3,900
Concrete for auxiliary foundations	.....	190
Traveling crane	.....	1,200
Cooling tower and foundations	.....	600
Fuel oil storage tank	550	950
Excavation and backfill for fuel tank	.....	176
Lubricating oil tank and accessories	.....	200
Station piping	3,000	1,200
Insurance on labor at 7 per cent	.....	320
Freight on machinery	2,000	2,400
Auxiliary equipment: silencer, water softener, etc	.....	250
Building (complete)	4,000	5,000
Land (rental value)	.....	100x
Sub-total	$67,582	$95,608
Mechanical Equipment		
Contingencies at 5 per cent	.....	$4,780
Tools and equipment rental at 1 per cent	.....	956
Contractor's overhead at 5 per cent of $11,986	.....	600
Contractor's profit at 5 per cent of $11,986	.....	600
Engineering and supervision at 10 per cent on total	.....	10,250
Total cost of mechanical installation	$67,582	$112,794
Electrical Equipment		
Generator panels	.....	$1,700
Sychronizing panel	.....	121
Feeder panels	.....	480
Electrical equipment for fuel and water pumps and centrifuge	.....	538
Insurance on labor at 7 per cent	.....	45
Freight	.....	54
Sub-total	.....	$2,939
Contractor's overhead at 5 per cent	.....	147
Contractor's profit at 5 per cent	.....	147
Sub-total	.....	$3,233
Engineering and supervision, 8 per cent	.....	259
Total cost of electrical equipment	$4,000	$3,492
Grand total — cost of complete installation for identical actual load conditions	$71,582	$116,286

Consulting engineer's estimate 162½ per cent of engine salesman's estimate

circumstances. Such a list will be helpful to the power salesman in making up his own estimates and it has been found that the mere display of such an array of essential items before the customer will give him pause and will raise in his mind the proper question: "Do you suppose they have left anything out of my engine contract?" If the display of such a check list should cause the customer to engage a fourth-party check by a competent consulting engineer so much the better for the customer and the power salesman. The use of a check list

Table II—Check List for Diesel Engine Generating Plant

1. Land

2. Railroad sidings

3. Building

1. Excavation
2. Foundations
3. Structural steel
4. Brickwork
5. Steel sash
6. Doors
7. Glass and glazing
8. Hardware
9. Toilet partitions
10. Concrete floors
11. Grating over pipe trenches
12. Checkered plate
13. Roof — steel deck
14. Roof — insulation and waterproofing
15. Ventilators
16. Plumbing
17. Heating
18. Lighting
19. Painting
20. Insurance on labor at 7 per cent
21. Sub-total
22. Tools and equipment rental (2 per cent of item 21)
23. Contractor's overhead (5 per cent of item 21)
24. Contractor's profit (5 per cent of item 21)
25. Sub-total
26. Engineering and supervision
27. Interest during construction
28. Total cost of building

4. Mechanical Equipment

29. Engines
30. Generators
31. Exciters, direct connected
32. One set of engine spare parts
33. Fuel oil day tank
34. Engine-driven air starting set
35. Fuel oil transfer pumps, motors and hand starters
36. Pyrometers, switches, thermocouples, lead wire
37. Air filters and auxiliaries
38. Water circulating pumps
39. Indicators
40. Centrifuge with heater tank, for manual control
41. Electric speed changers
42. Erection of engines, generators and auxiliaries
43. Excavations for engine foundations
44. Concrete for engine foundations (min.)
45. Concrete for auxiliary foundations
46. Traveling crane
47. Cooling tower and foundations
48. Fuel oil storage tank (12,000 gal.)
49. Excavation and backfill for fuel tank
50. Lubricating oil tank and accessories
51. Station piping
52. Insurance on labor at 7 per cent
53. Freight on machinery
54. Sub-total
55. Contingencies at 5 per cent
56. Tools and equipment rental at 1 per cent
57. Contractor's overhead on items 43 to 52 at 5 per cent
58. Contractor's profit on items 43 to 52 at 5 per cent
59. Sub-total
60. Engineering and supervision
61. Interest during construction
62. Total cost of mechanical equipment

5. Electrical Equipment

63. Generator switchboard panels — A
64. Generator switchboard panels — B
65. Synchronizing panel — C
66. Feeder panels — D
67. Feeder panels — E
68. Feeder panels — F
69. Equipment for two fuel oil transfer pumps
70. Equipment for water circulating pumps
71. Equipment for centrifuge
72. Insurance on labor at 7 per cent
73. Freight
74. Shop equipment and tools
75. Sub-total
76. Contractor's general overhead at 5 per cent
77. Contractor's profit at 5 per cent
78. Sub-total
79. Engineering and supervision
80. Interest during construction
81. Total cost of electrical equipment
82. Grand total investment

6. Operating Cost Items

1. Fuel oil
2. Lubricating oil
3. Attendance labor
4. Supervision and clerical (including accounting overhead)
5. Extra labor (not included in maintenance)
6. Maintenance
7. Repairs
8. Supplies
9. Water (including pumping and treatment)
10. Purchased power
11. Cost of operating auxiliary units
12. Interest on total investment
13. Insurance and taxes on total investment

will sometimes be the easiest way to convince the purchaser that such innocent-looking items as "building" and "installation" may be incidental to the engine company but downright expensive to the purchaser.

Such a check list applied to "Operating Costs" will probably apprise the customer for the first time that Diesel engines require plenty of properly treated cooling water. The customer may not have realized before that Diesel engines frequently require extra labor of a specialized nature where provision has not been made for proper maintenance through employment of trained operators. It is easy for the engine company to say that a Diesel will cut the cost of power in two—it is quite another thing to put together all of the hundred-and-one related and unrelated items comprising a *complete* Diesel plant and then to make it perform under the watchful eye of "any automobile mechanic." Would the average automobile mechanic be competent to maintain all of the equipment, buildings and all, included on this check list?

Analyze the contract with the customer

The second method suggested for making the customer "conscious" of his situation when about to purchase a Diesel engine is to analyze, before his very eyes, his so-called contract to pay out of savings and to show him how likely it is that the payments will actually come out of his coffers. Here, too, the omissions from the contract are quite as significant as in the salesman's estimate of total investment required. After pointing out the deficiencies of the engine contract the power salesman may then set down on one sheet of paper the actual cash outlay required to comply with the provisions of the contract and to provide an adequate and reliable source of power, equivalent in all respects to his purchased power service. The total of such items will astonish the most ardent "believer" in Diesel magic.

Let us consider some omissions and weaknesses of a typical Diesel contract of the "payment-out-of-savings" variety, more particularly called an engine lease:

1. Date of delivery not guaranteed.

2. Engine guarantee of output based on factory tests.

3. Guarantees of economy in fuel and lubricating oil based on three eight-hour tests (duty of engine would be continuous).

4. Cost of foundations, oil and water lines, wiring, conduit, cartage, common labor and all materials for erection—omitted from contract. Such items frequently run to large proportions of the bare engine cost.

5. Cost of tests not included in contract price. No provision for measuring output of engine in kilowatt-hours for compressor drive. The utility supplies kilowatt-hours, not brake horsepower hours. There *is* a difference, though not all customers are aware of just *what* difference.

6. If the engine fails to meet guarantees it is removed without expense, but the foundations are not removed, neither is the labor that went into making them or in getting the plant ready, or in providing the building.

7. Defective parts are replaced, but engine user pays the freight and installation.

8. Lessee only has option to acquire title for $1 *after* all rentals have been paid. If actual savings are less than anticipated, the rentals are merely "continued," not cancelled.

9. If legal action is taken to repossess, the lessee pays all fees and costs.

10. The lessee pays the insurance—insurance companies will not take their pay out of savings.

11. Payments are predicated upon a fixed amount of energy and a fixed level of power rates, with the customer making up for any deficiencies in the actual savings because of a drop in volume of business and drop in energy requirements. An engine delivering less than half its estimated output will require many a year to pay out of savings. And interest on unpaid rental certificates goes merrily on.

12. Allowances for taxes, insurance and maintenance fixed in advance at a very modest sum: On an investment of $20,000 for engine alone (total investment would exceed $25,000) the allowance for insurance was $240 per year; taxes were not to exceed $360 per year, and no estimate was allowed for maintenance or attendance labor, beyond the bare cost of repair parts furnished by manufacturer.

13. Contract fails to state who makes these payments out of savings, unless it be the lessee. If the savings do not materialize the engine remains as a white elephant—a daily reminder of the old adage, "You cannot get something for nothing," even from a Diesel manufacturer.

Now put down on paper in front of the prospective purchaser of an engine the dollar and sense values of the above significant omissions from his engine contract. This was done in one instance, with the following results:

Cost of equipment, delivered	$20,100	
Cost of installation (item 4 above)	2,300	
Total investment		$22,400
Contract price to include installation		$22,400
Cash payment at time of purchase		2,500
Balance of deferred payments		$19,900
Initial cash outlay by customer		$2,500
Monthly payments to engine company	$553	
Average monthly interest on balance	51	
Sinking fund on initial payment at 2 per cent per month	50	
Interest on initial payment at 0.5 per cent per month	12.50	
Insurance and taxes at 3 per cent on $22,400	57	
Standby service to carry half the load at $3 per month per kw. (75 kw.)	225	
Total monthly costs exclusive of operation and depreciation		$948.50
Monthly operating costs, 58,460 kw.-hr		608.00
Total monthly out-of-pocket cost of engine power		$1,556.60
Actual cost of purchased power		1,023.50
Monthly loss with Diesel engine power		$533.00

The customer had been encouraged to believe the engine would pay for itself in three years. Instead of that we have:

Accumulated *loss* over three-year period	$19,188.00

Can there be any real saving with Diesel engine power until *after* the engine has been paid for? If the savings do not materialize, who backs the guarantee, the engine company or the customer?

A contract that really guarantees

A third suggestion for bringing home to the customer the importance of getting the guarantees on the right side of the agreement is contained in the following suggested agreement to be made between the prospective Diesel engine purchaser and the engine company.

Such an agreement may be offered if and after the customer has refused to arrange for a joint conference with the power salesman and the engine salesman. Such a conference would enable the customer to have the benefit of a critical scrutiny of both the engine company and power company proposal, and would be welcomed by many customers. If the engine salesman demurs, the customer's deductions would not hurt the cause of purchased power. If, however, either the customer or

engine company refuses to have a joint conference the salesman may bring the controversy to an end by suggesting to the customer that he offer the following contract to the engine company. This contract places upon the engine company some of the obligations it generally asks the customer to assume. If the engine company refuses to sign such an agreement the power salesman has little to worry about. If the engine company accepts the customer has little to worry about and the power salesman has the satisfaction of knowing that he has done his part in bringing out into the light all the essential elements of the comparative analysis of Diesel and purchased power. Such a contract, signed simultaneously with the engine purchase contract, will make up in positive virtues for many of the sins of omission in the Diesel contract itself.

Suggested Agreement to Be Made Between Prospective Oil Engine Purchaser and Diesel Engine Company

(Designed by H. D. Ballard)

AGREEMENT made this....day of....., Nineteen Hundred and...., by and between ....., a corporation of ....., party of the first part (the purchaser), and ....., a corporation of ....., party of the second part (the seller).

Whereas the purchaser wishing to clarify and make certain, statements and guarantees of the seller with reference to the installation of an oil engine plant of....kw. capacity by the seller, for the main purpose of furnishing power to take care of the manufacturing needs of the purchaser, and

Whereas the parties hereto desire to definitely provide a method of determining the savings obtained from the operation of said plant and the manner of payment for its installation.

NOW THIS AGREEMENT WITNESSETH: That in consideration of one dollar ($1) by each to the other paid, the receipt whereof is acknowledged, and in consideration of the mutual undertakings and promises hereinafter set forth, the parties hereto do hereby promise and agree with each other as follows:—

ARTICLE I

1. The term of this agreement shall commence on the in-service date of said Diesel electric generating plant, as hereinafter defined, and shall continue in force until full payment is made under the provisions herein contained, or until terminative under provisions of Article VI.

2. The in-service date of said Diesel electric generating plant shall be the date when the oil engine electric generating plant is completely installed and demonstrated by test to be ready for operation. The purchaser shall then take complete charge of said plant and operate the same in an efficient and economical manner.

ARTICLE II

The statements and guarantees of the seller as to the efficiency and economy of the proposed oil engine installation shall be attached to and made a part of this agreement. In addition to the acceptance tests which will be made upon installation, and which must agree with the guarantee in results, an annual test to determine the oil consumption, both fuel and lubricating, will be made. Since the payments for the oil engine equipment are to be made on the basis of savings, and those savings are shown as the result of test values, an adjustment in the payments will be made accordingly after each annual test to compensate for any decreased or increased efficiency. Where it is not practical to make an actual test, actual quantities of oil, both fuel and lubricating, will be measured for a given number of kilowatt-hours produced over the period of average operation.

ARTICLE III

Method of Computing Diesel Electric Energy Costs

The purchaser shall compute the cost of Diesel-generated electric energy from said in-service date for monthly periods by totaling each item as hereinafter described.

(a) *Supervision and Superintendence*—A charge of $.. per month shall be made for this item, including labor to keep necessary records, etc.

(b) *Labor*—Actual time paid to operators and helpers.

(c) *Labor Overhead*—To be charged on a percentage basis equal to the overhead charged against other labor of the maintenance staff of the owner.

(d) *Fuel Oil*—To be determined by total price for fuel oil delivered to the owners' storage tanks at the time of purchase.

(e) *Lubricating Oil*—Same as for fuel oil.

(f) *Repairs and Supplies*—An accurate record of all repairs made and supplies delivered to the Diesel electric plant, including all auxiliaries and piping, and regardless of who makes repairs or provides supplies.

Cleaning Cylinders, Etc.—An accurate record of time used by and wages paid to any man employed for this work, plus overhead thereon, shall be kept.

Out-of-Service Time—Number of hours plant was out of service for repairs and enforced maintenance.

(g) *Cooling Water*—Total cost of all water used in Diesel electric plant.

(h) *Cooling Water Treatment*—Total cost of any charges incurred for treatment of cooling water.

(i) *Interest at 8 per cent on Supplies*—Fuel oil, lubricating oil, spare parts, etc., in storage.

(j) *Interest* at 8 per cent on down payment and other installation costs.

(k) *Interest* at 8 per cent on unpaid balance prorated over period of expected full payment.

(l) *Amortization* of down payment and other installation costs at 17.7 per cent. (Five years to "pay out").

(m) *Insurance*—Fire casualty, explosion, use and occupancy, workmen's compensation, etc.

(n) *Purchased Power*—As found necessary for station or factory lighting, or power used either in conjunction with or auxiliary to that provided by engine, standby service, or otherwise.

(o) *Contingencies*—To be charged in accordance with expenditures.

(p) *Rental*—For space (if new building is not required).

(q) *Taxes*—On pro rata basis of entire factory.

ARTICLE IV

Method of Computing Equivalent Central-Station Electric Eneregy Costs

1. The purchaser shall estimate the amount of equivalent central-station energy for each of said monthly periods from said in-service date by determining the net Diesel energy used in the operations of the purchaser, and adding thereto the estimated amounts of transformer losses, if any. All Diesel energy used for lighting of the Diesel engine room, and auxiliaries, and for power to Diesel engine auxiliaries, shall not be considered as used in the operations of the purchaser.

2. The purchaser shall compute the cost of equivalent central-station electric energy for the said monthly periods under an applicable rate schedule of the public utility operating in the territory where the purchaser is situated, as if the purchaser had purchased his power requirements from the public utility. Allowance will be made for any rate reductions power company may make. To this cost shall be added the cost of transformer rental (if any) and all other costs as charged by said public utility in accordance with its standard practices.

ARTICLE V

1. The monthly operating savings shall be the amount by which the equivalent central station electric energy costs, as determined under Article IV hereof, exceed the Diesel electric energy costs, as determined under Article III hereof. The minimum operating savings will be $.. per year, as shown by the total of the first twelvemonth period of this agreement.

2. At the end of any yearly period, or portion thereof, of the term hereof, purchaser shall total the monthly operating savings.

3. If the cost of producing the net power used for a given period not to exceed one (1) year is less than the cost of purchasing that amount of power, then the payment to the seller shall be that difference, since the oil engine equipment is to be paid for out of the savings.

4. If the cost of producing the net power used for a given period, not to exceed one (1) year, is more than the cost of purchasing that amount of power, then the seller shall refund difference to the purchaser.

ARTICLE VI

Diesel Plant Abandonment

1. If at the end of the first yearly period of the term hereof the total of the twelve monthly operating savings, as determined under paragraph 1 of Article V hereof, is less than the amount guaranteed for a one-year period by the seller, and these operating savings do not constitute enough to total the minimum payment as set forth in Article V, paragraph 1, then, at the option of the purchaser, these agreements shall cease and terminate, and the seller shall repay to the purchaser all previous payments, plus all interest paid by the purchaser, and shall dismantle and remove the said Diesel electric generating plant from the premises of the purchaser.

Surety

The seller hereby agrees to furnish a bond in the sum of....dollars ($..) for the faithful performance of all the conditions, stipulations and requirements of this contract, with sufficient surety to be approved by the purchaser.

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be duly executed in duplicate the day and year first above written.

Removing Heat from High-Intensity Lighting

COMBINATION incandescent and mercury-tube lighting fixtures have been applied commercially in at least three installations in Philadelphia—the main salesroom of the Kensington office of the Philadelphia Electric Company, a salesroom of the Philadelphia Gas Works and the John Wanamaker store. Among reasons given for using this combination are: Resulting light blends better with daylighting through windows, give psychological effect of coolness, approaches natural daylight closely enough for all but most exacting color-matching operations and the approximation of color correction is obtained without sacrificing efficiency of light source through absorbing mediums. As developments permit using smaller ratings than 575 watts per mercury unit and simplify auxiliary equipment so it may be more easily concealed, the deterrents to more extensive use will be removed, according to reports.

Fig. 1—Each ceiling panel contains 8.5 kw. in incandescent and mercury-vapor units

Of particular interest is the Kensington installation. The room, measusing 110x40 ft., is illuminated by eight 5x8-ft. artificial skylights made of white alabaster diffusing glass and projecting below the ceiling. Each contains thirteen 500-watt incandescent lamps and four 50-in. mercury tubes, making 8.5 kw. per fixture. This ratio of mercury-tube to incandescent lamps was found the best to give the desired color and an illumination intensity of 40 ft.-candles.

Such a large dissipation of heat (15.5 watts per square foot of floor space) presented a problem. If discomfort resulting therefrom had to be prevented by the air-conditioning equipment, a considerable additional investment and operating expense would have been entailed. Consequently a partly closed cylinder of Macbeth heat-absorbing glass was placed around each incandescent lamp, through which air is drawn by a ventilating duct system connected to each fixture. It has been found necessary to run the ventilating fan for at least five minutes after the lights are shut off to avoid breakage of the glass by the sudden storage of heat which would otherwise occur.

The ventilator withdraws the air from each fixture at the rate of 600 cu.ft. per minute, discharging it outdoors in warm weather. When heat is needed in the building the air withdrawn from the fixtures is delivered to the air-conditioning system in such proportions as required. This construction was justified, it is reported, as it cut the cost of the air conditioning system in half. The steam-heating system is used only on the very coldest days.

In this case the total initial expense for the building was less than had the alternative solution been adopted

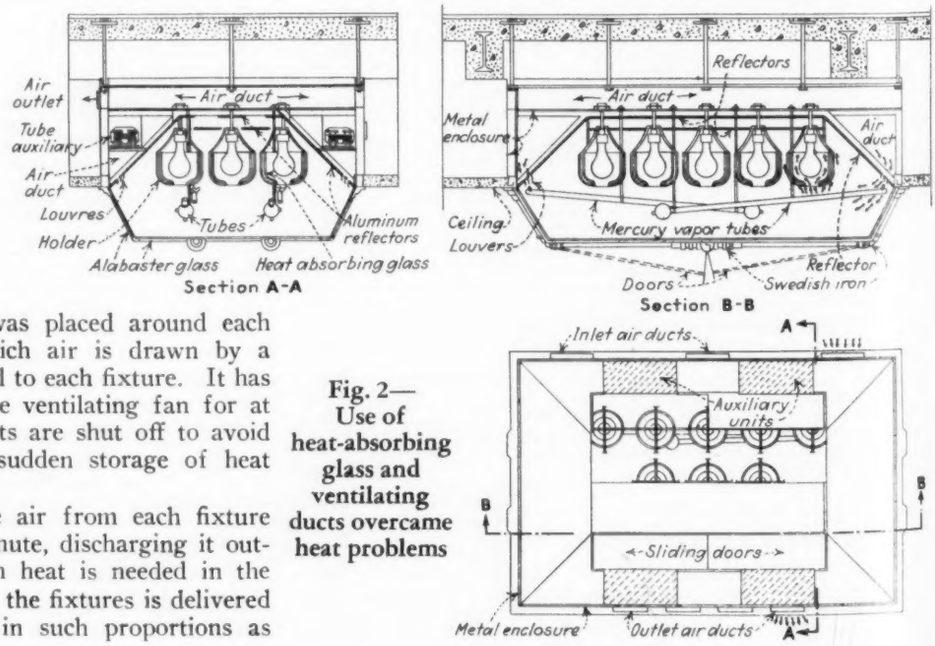

Fig. 2—Use of heat-absorbing glass and ventilating ducts overcame heat problems

and the use of ventilating ducts was a positive economy, according to reports. A detailed analysis of the economics of the system is now being made by the Philadelphia Electric Company, but it will not be completed for some time, according to G. Bertram Regar, manager of the lighting department.

Custom-built suspension fixtures are used in the Philadelphia Gas Works installation. Each contains a mercury tube bent into a rectangle and placed concentric with the group of incandescent lamps. Concealment of the vapor-tube auxiliary is afforded by a central housing in the lower part of the fixture. The cost of this installation is reported to be about the same order of magnitude as a straight incandescent lighting installation for the same character of work. The dominant motive which induced the user to install this system was the fact that the resultant color was so near daylight that there was no noticeable clash between it and the light entering the front window.

In the Wanamaker store one room is lighted by four pylons, one in each corner. Each contains two standard industrial mercury-vapor tubes and sufficient incandescent wattage to obtain the desired color.

Some persons believe that this type of lighting is still in the Rolls-Royce class and that considerable development work yet must be done before it will appear as a standardized mass-production product. As to cost, A. A. Brainerd, Philadelphia Electric Company, says: "I see no reason why the expense of installing combination lighting should be excessively high in commercial or public interiors where the other appointments justify custom-built decorative lighting. It does lend an entirely different atmosphere which many discriminating customers like. I understand that there are now on the market several types of standardized fixtures which can be bought in some cases as low as $70 apiece."

▼

Savings in Industrial Installations*

"Plants having line-shaft drive usually are overmotored under present operating conditions. Here are some recommendations we have made recently:

"Two 15-hp. motors were driving two fan systems. One fan was enough to do the work. Therefore, the two ducts were connected, saving 15 hp. connected.

"A 30-hp. and a 25-hp. motor were driving two line shafts. The shafts were belted together, saving 30 hp. connected.

"Three 10-hp. motors were driving three line shafts. The shafts were tied together and driven by one 10-hp. motor, saving 20 hp. connected.

"One 100-hp. motor was driving a line shaft. The line was split and two 30-hp. motors now carry the load. saving 40 hp. connected.

"Two 40-hp. motors were driving two line shafts with an actual load of 5 hp. per line shaft. The shafts were belted together and driven by a 15-hp. motor, saving 65 hp. connected.

"Along with motor drive should be considered motor-generator sets. Often much direct-current equipment has been changed to alternating current, but the motor generator set rolls merrily on. One 50-kw. unit was tested, was found to have a 15-kw. load and was changed to fit the job."

From the power sales files of the Cleveland Electric Illuminating Company, cited by W. E. Benninghoff to Electrical Maintenance Engineers' Association at Electrical League of Cleveland.

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Unit Costs Based on Construction, 1926-1931

Segregated figures on the investment in electric light and power systems, even for the broadest breakdown into a few principal elements, are notoriously lacking. An approach can be made by comparing the sum of new capital expenditures over a recent period of years with the physical growth of the industry. Taking the six-year period from 1926 to 1931 inclusive, the aggregate capital investment in new construction as published in our annual statistical issues is given in the table herewith. The exact capacity in fuel and in water power plants at the beginning of 1926 was not reported, but can be estimated. It gives, for the six-year period, a net increase of:

Fuel power, kw.	8,400,000
Water power, kw.	3,500,000
Total, kw.	11,900,000

Combining this information, we have:

	Investment	Kw.	Dollars per Kw.
Fuel power plants	$1,059,000,000	8,400,000	126
Hydro plants	631,000,000	3,500,000	178
Transmission	966,000,000	11,900,000	81
Distribution	1,982,000,000	11,900,000	166
Miscellaneous (four years)	212,000,000	11,900,000	18
	$4,850,000,000		

During the period 6,000,000 customers were added, of all classes. Using the investment for distribution, as above, gives $330 per customer. These figures cannot be taken "in the raw" as giving accurate averages either for existing investments or for present unit costs of new construction, but they do furnish a basis for further analysis:

(a) Investment in new steam plants presumably includes some additions to boiler plant, etc., not represented in the kilowatt figures of new generator capacity, and of additional kilowatts without corresponding added boilers. Over a six-year period these should largely balance.

(b) Hydro investment per unit is probably too low for normal conditions, for it includes the kilowatts of generators lately installed, while the really expensive parts—dams, submerged land—were paid for in earlier years. Corresponding new expenditures for future plants, which normally would tend to balance this source of error, were doubtless held to a low figure, at any rate during the latter portion of the period.

(c) If transmission lines are considered as being used to bring energy to load centers, then those connected with hydro plants will in general be longer than those with steam plants and the cost of transmission per kilowatt of generator rating of the former will exceed the average of $81. The average figure would apply, rather, to the transmission network as a whole, irrespective of the source of energy.

(d) Distribution, $166 per kilowatt of new power plant and $330 per new customer, is too high by whatever was invested in remodeling of lines serving existing customers and not charged to maintenance.

More Testimony for Ground Wires

Evidence of the effectiveness of ground wires in reducing transmission line interruptions continues to accumulate. The latest addition to its recorded data is contained in a report of the Great Lakes N.E.L.A. overhead lines committee, presented by E. W. Hatz. The report summarizes operating records from thirteen different companies covering 10,559 miles of transmission lines in the Great Lakes region. For the purpose of the study a line interruption is defined as an unpremeditated loss of electrical continuity between line terminals, usually caused by the opening of an oil circuit breaker or fuse at one or both ends. Prearranged outages and voltage disturbances not accompanied by breaker trip-outs are not classed as interruptions, nor is the matter of service outage to customers introduced in any way.

The general conclusions of the report, which are apparent from the study of the tables here reproduced from it, are:

1. The number of interruptions per 100 miles was higher in 1931 than in previous years, probably due to a great number of exposures to lightning.

2. On the higher voltage lines lightning still continues

Table I—Summary of Interruptions by Classes—1931

In this table is a summary of the number of miles of line and the number of interruptions per 100 miles for each type of construction for each voltage class. It is of interest to note that 80 per cent of all lines of 100 kv. or over utilize steel towers for support and are protected by one or more ground wires. In the 60 to 100 kv. voltage range the use of steel is more general than the use of wood for supporting structures. More lines are equipped with ground wires than are without such protection, but there is not enough difference to indicate that either construction is regarded with more favor than the other by designing engineers. The use of one type of construction for lines in the 30 to 60 kv. class is even more pronounced than in the case of lines above 100 kv. Ninety-nine per cent of these lines use wood for supports and are not protected by ground wires. In each of the voltage ranges where one type of construction predominates it will be observed that the interruption record fully justifies the use of that construction.

Class	Voltage	Ground Wires	Supports	Mileage	Interruptions per 100 Miles: Lightning	Other Causes	Total
A-1	Above 100 kv.	Yes	Wood	89.7	15.6	2.3	17.9
A-2		Yes	Steel	2,969.6	7.9	8.8	16.7
A-3		No	Wood	0.0	0.0	0.0	0.0
A-4		No	Steel	633.6	42.8	11.4	54.2
B-1	60 to 100 kv.	Yes	Wood	755.7	23.9	20.1	44.0
B-2		Yes	Steel	966.7	22.9	11.5	34.4
B-3		No	Wood	584.0	48.7	20.9	69.6
B-4		No	Steel	747.1	42.1	28.2	70.3
C-1	30 to 60 kv.	Yes	Wood	30.0	96.6	76.7	173.3
C-2		Yes	Steel	0.0	0.0	0.0	0.0
C-3		No	Wood	3,775.2	47.0	23.2	70.2
C-4		No	Steel	7.4	216.0	95.0	311.0
				10,559.0	31.6	17.4	49.0

Table II—Analysis of Interruptions

In this table are shown analyses of interruptions of lines above 100 kv. on steel towers with ground wires and on lines of 30 to 60 kv. on wood poles without ground wires. These two classes of construction predominate in their respective voltage ranges.

Equipment Involved	Basic Causes	Lines Above 100 Kv., Steel Towers With Ground Wires — Class A-2: Interruptions per 100 Miles	Per Cent Total	Lines 30-60 Kv., Wood Poles Without Ground Wires — Class C-3: Interruptions per 100 Miles	Per Cent Total
Insulator flashover	Lightning	8.0	47.8	46.8	66.7
Foreign to line	Foreign faults	1.9	11.4	6.7	9.6
Conductor short circuits	Whipping	0	0	1.7	2.4
Foreign to line	Incorrect relaying	0.7	4.2	1.5	2.1
Unknown	Unknown	5.0	30.0	9.3	13.2
Foreign to line	System disturbances	0.1	0.6	0.9	1.3
Foreign to line	Miscellaneous	0.3	1.8	1.1	1.6
Conductor short circuits	Wind	0.7	4.2	1.7	2.4
All other causes		....	....	0.5	0.7
		16.7	100.0	70.2	100.0

Table III—Interruptions With and Without Ground Wires

Here is shown the total of interruptions due to lightning and to all other causes for lines with and without ground wires. This table shows that the use of ground wires as indicated by the total mileage in each class is justified by the reduced number of interruptions per 100 miles of lines. This may not be stated to be true of the 30 to 60 kv. lines where the length of line protected by ground wire is too small to justify general conclusions. The reduction in number of interruptions due to the use of ground wires is greater on the higher than on the medium voltage lines, as would be expected. It is also of interest to note that in all voltage classes the number of interruptions due to causes other than lightning is less on lines equipped with ground wires than on those without such protection.

Type of Line	Mileage	Lightning Interruptions: Total	Lightning Interruptions: Per 100 Miles	All Interruptions: Total	All Interruptions: Per 100 Miles
Above 100 kv.					
With ground wires	3,059	249	8.1	513	16.7
Without ground wires	634	271	42.8	343	54.2
60 to 100 kv.					
With ground wires	1,722	402	23.3	665	38.6
Without ground wires	1,331	599	45.0	932	70.1
30 to 60 kv.					
With ground wires	30	29	96.6	52	173.3
Without ground wires	3,783	1,787	47.2	2,671	70.6
All lines					
With ground wires	4,812	680	14.1	1,230	25.6
Without ground wires	5,747	2,657	46.1	3,946	68.8
Total	10,559	3,337	31.6	5,176	49.0

Table IV—Interruptions by Years

Lines above 100 kv.

This table shows the interruption record of transmission lines in the Great Lakes region for six years. Among the factors which influence the number of total interruptions as recorded is the possibility that when these records were started interruptions were not reported with as much care as they are today. The effect of this would be to make the earlier records appear better by comparison with the more recent ones. Another factor tending to increase the number of total interruptions is the more complete interconnection of lines and systems. The rapid increase in the number of interconnections has probably increased the number of interruptions due to faults on adjacent lines, but it is to be expected that improved relay operation will gradually eliminate this source of trouble. Opposed to this tendency for interruptions to increase are improvements in design which will eventually result in decrease. The trend in transmission line design is toward greater immunity from lightning and as economic conditions improve and construction projects are resumed this influence will tend to turn the interruption curve downward.

Year	Lines With Ground Wires: Mileage	Interruptions per 100 Miles: Total	Lightning	Lines Without Ground Wires: Mileage	Interruptions per 100 Miles: Total	Lightning
1927	1,490	8.8	5.8	759	21.0	12.2
1928	2,129	15.8	6.9	690	26.5	17.2
1929	2,660	16.0	7.0	673	37.4	20.9
1930	2,938	10.2	4.6	560	34.8	14.0
1931	3,059	16.7	8.1	634	54.2	42.8

to account for approximately one-half of the total number of interruptions.

3. The number of interruptions on lines below 100 kv. is from two to four times as great as those on lines above 100 kv.

4. On lines above 100 kv. the presence of the ground wire reduces the number of interruptions due to lightning to approximately one-half to one-fifth as many as on lines where there is no ground wire.

5. On lines from 60 to 100 kv. ground wires reduced the interruptions in 1931 to approximately one-half as many as on lines without a ground wire. On lines below 60 kv. there is insufficient data on lines with ground wires on which to draw any general conclusions.

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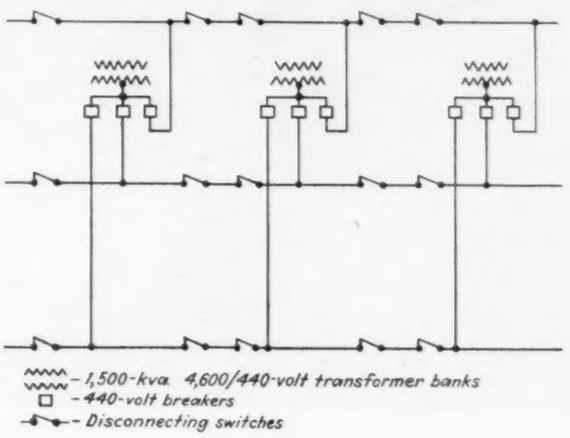
Builds Rural Line for $865 per Mile

A long-span rural line design has been used successfully by the Central Maine Power Company with an average cost of $865 per mile, including engineering, superintendence, liability insurance and other overhead charges in addition to construction material and labor, but excluding meters, transformers and services. This average is for six extensions varying in length from 0.55 to 4.4 miles and totaling 14.05 miles. Typical angle, transformer and guy poles are illustrated. Thirty and 35-ft. poles are used, with spans averaging about 275 ft., maximum 300 ft., and minimum 250 ft. Ordinary No. 6 medium hard-drawn copper wire is provided, without splices in mid-section. Since the drawings were made the company has found that it is better to use a type of clevis insulator with a through bolt instead of an eye bolt.

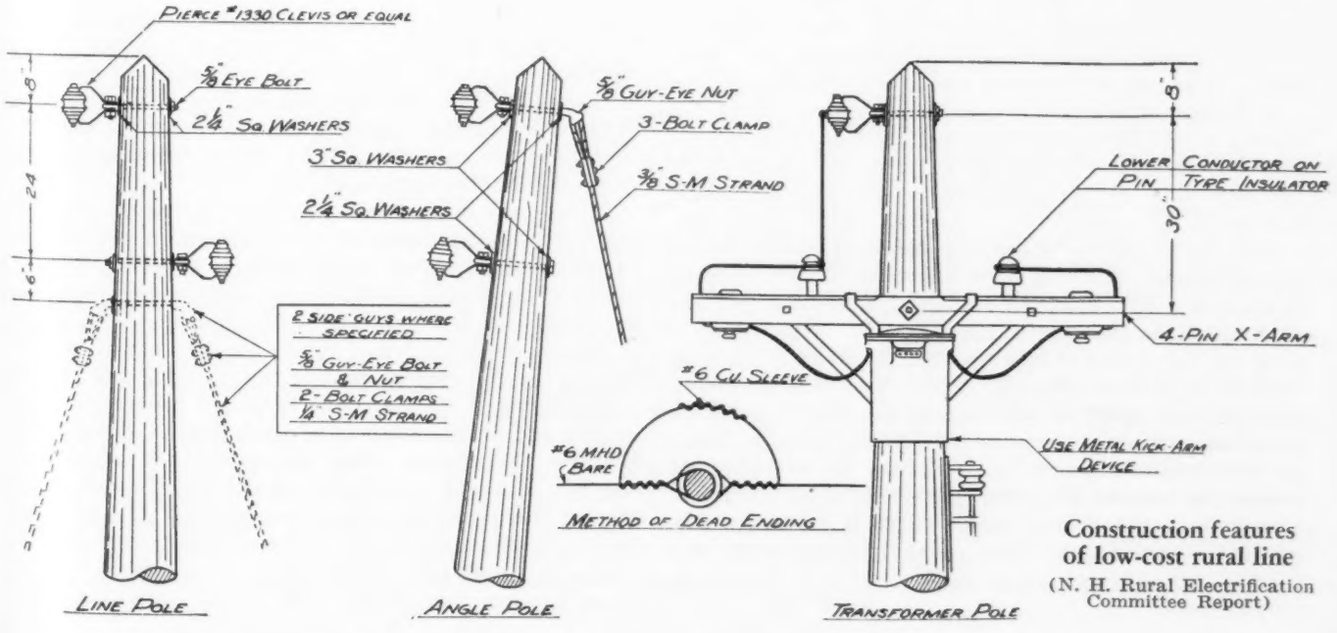
Actually the cost of this type of line is about $800 per mile, as engineering development charges were included in the sections above described amounting to about $70 per mile.

Distribution Flexibility in Plymouth Motor Car Plant



Because of the shape and design of the factory of the Plymouth Motor Corporation, a single-floor mill-type building about a mile long, it was comparatively easy to lay out for it a very simple and at the same time extremely flexible scheme of power distribution. Three sets of three single-conductor 500,000-circ.mil. rubber-covered cables are carried in open construction on the building steel practically the whole length of the plant. These feeders are supplied from three 1,500-kva. transformer banks located at approximately equal intervals. Each supply lead from the transformer banks to the feeders includes a circuit breaker and disconnecting switches are located in the feeders at intervals determined by load densities. It is thus possible for any feeder section to be carried on either transformer bank adjacent to it or to be fed from a farther bank if an adjacent bank is out of service.

With all breakers and disconnecting switches closed the system might be operated as a secondary network, but this is not done because satisfactory regulation can be attained by grouping the feeder sections to be fed separately from the transformer banks. Rearrangements of machinery, such as usually occur to a greater or less extent in an automobile plant when preparing for production of a new model, do not require any changes or modifications in the main scheme of electrical distribution and changes in capacity may be taken care of easily by cutting out or adding to the number of transformer banks.



Construction features of low-cost rural line
(N. H. Rural Electrification Committee Report)

Service Reliability Keynote of Anthracite Breaker Design

By RAYMOND A. HOPKINS*
Consulting Electrical Engineer

CONTINUITY of electrical service combined with efficient operation feature the design of the Philadelphia & Reading Coal & Iron Company's latest anthracite breaker at St. Nicholas, Pa. A total connected motor load of 9,400 hp. serves this installation, which has a capacity of 1,000 long tons of coal per hour, and the demand measured over a two-hour period at 98.5 per cent power factor is 3,600 kw. In the ELECTRICAL WORLD, October 25, 1930, page 782, the Locust Summit breaker of this company was described. That installation had many unique features of electrical interest, and while certain basic elements in its design were utilized in the new breaker, the engineers of the company and of the Stone & Webster Engineering Corporation, consultants for the coal and iron property, characterize the St. Nicholas plant as the latest step in advance of the coal industry.

Raw coal from the adjacent mines is railroaded to the central breaker, purified, sized and reloaded for shipment to market. The principal elements in the process are represented in the flow sheet (Fig. 1). Purifying is done by the flotation process, using ten cones ranging from 10 to 18 ft. in diameter, and having slow-revolving motor-driven agitators. Sizing of the raw coal before and after purifying is accomplished by flat screens shaken by motor-driven eccentrics. Refuse is washed over screens to remove the sand and is then collected and conveyed to the refuse bank, where it is finally distributed by an electric train. Handling equipment and auxiliary facilities, not shown on the flow diagram, but most of which are motor-driven, include a rotary car dump, car wash, conveyors, feeders, pumps, weighing devices and inspector's laboratory.

The process machinery in the breaker is arranged in two parallel trains, each independent of the other, but both depending on a central supply of raw coal, a central disposal of refuse and a central loading bay for refined coal. With this arrangement either half of the breaker and the central facilities may be operated for 50 per cent production and both halves and the center for full production.

One of the most serious design problems of coal breaker electrification is protection of equipment and wiring from water, dirt, sand and grease. Water protection is particularly important as very large quantities of water are used throughout the process and as the hose is used, sometimes somewhat indiscriminately, in washing down the building and machinery.

Motors are, in most cases, of splash-proof design, having ventilating cowls which open downward. A number of the smaller motors in particularly exposed locations are totally inclosed. Ball bearings with grease lubrication are used with few exceptions. Realizing the possibility of trouble with the usual type of grease-lubricated ball bearing in this severe service, on the one hand from overgreasing if grease connections are provided on the motors and on the other hand from getting grit into the bearings if bearings must be opened for regreasing, one of the motor manufacturers developed a new bearing for this particular class of application. It is provided with a positive grease seal to prevent lubricant passing along the shaft into the motor, a relief valve to allow excessive grease to escape where it will do no harm and

Formerly electrical engineer Stone & Webster Engineering Corporation.

a grease connection so located that the new grease passes directly through the ball race, pushing the worn-out grease ahead of it, out through the relief valve. The larger motors have ball and roller bearings with oil lubrication.

Control equipment located out around the process machinery, such as push-button stations, drum switches, signal buttons, etc., is of strictly splash-proof construction, having cast-iron boxes, rubber gaskets and glanded, guarded buttons. Motor primary and secondary controls are located in control rooms for protection. The 2,200-volt control rooms are of masonry construction, while the 440-volt control rooms are of sheet steel welded on light structural steel frames. All rooms are ventilated by small fans with thermostat control.

Wiring is protected by rigid steel conduit made splash-proof throughout, ventilated and drained. Flexible connections to belted motors are made of high grade, flexible metal steam hose with soldered connections.

The entire electrical installation is designed safely to withstand splashing water coming from any direction above the horizontal.

Distribution—Reliability and economy are both obtained by the distribution system used, representative parts of which are shown in the elementary one-line diagram of Fig. 2. Two 66-kv. lines of the Pennsylvania Power & Light Company feed the two main transformers and a tie switch between the two is provided just ahead of the transformers. In case of outage of one line, one transformer can carry the entire load temporarily until the tie switch is closed, after which both transformers may be operated from the one line indefinitely. Should a transformer fail, the other will carry the load until the tie switch from the yard lines can be closed, which brings in reserve energy from another substation at the same colliery. A fault on either the west or the east section of the bus would shut down only half of the breaker, permitting undiminished output from the other half. Oil circuit breakers are serviced while the breaker is not in operation. The five power transformers are alike and interchangeable, as also are the eighteen lighting transformers.

Economy is obtained principally by carrying the higher voltages and main cables as close as practicable to the load centers. The substation is located advantageously with respect to the breaker and the main switchboard is located in the breaker at a point nearest the substation so as to shorten the main 2,300-volt cables as much as possible. The 2,200-volt group buses are located directly over the pump room, permitting short leads to most of the 2,200-volt motors. The power transformers, 2,200-440-volt, are located on the ground just outside the building wall at points directly opposite the 440-volt group buses. The short 440-volt secondaries from the power transformers are split and fused to still further economize on copper. The lighting and small power transformers, 440-220 volts, are located close to the lighting cabinets and, being fed in each case from the nearest 440-volt group bus, have short primary and secondary connections. Control circuits for 440-volt motors, which originate at the motor controllers, are carried most of the way to the push buttons in the same conduits with the motor leads.

440-Volt Controllers—New designs were developed for the 440-volt motor primary and secondary controllers (Figs. 3 and 4) providing safety, accessibility and economy. Their arrangement in a typical control room is indicated in Fig 5. Interlock switches, front operated, double throw, with from three to eight poles as required, are provided at the tops of those primary panels which control interlocked motors. Control wire ducts are provided on all primary and secondary panels. Primary and secondary panels are dead-front, back connected and the backs are accessible. The space behind the assembled board is closed by end grills.

The buses over the control boards are of $2 \times \frac{1}{4}$-in. copper bar, taped with varnished cambric and supported on standard porcelain bus supports. The connections to

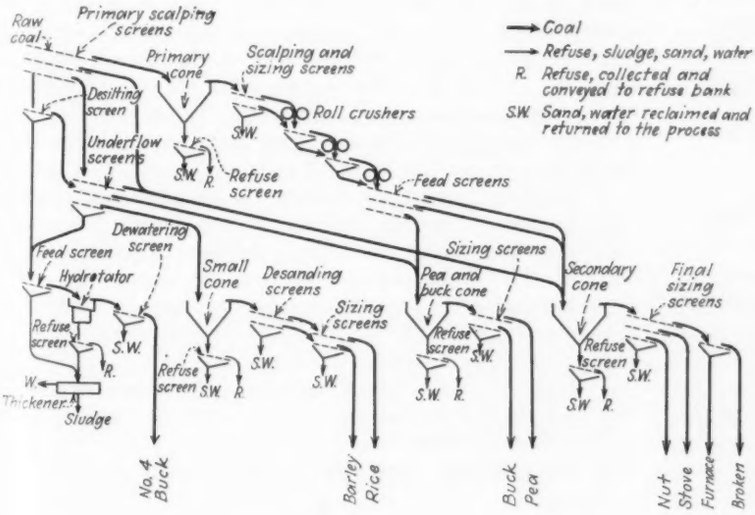
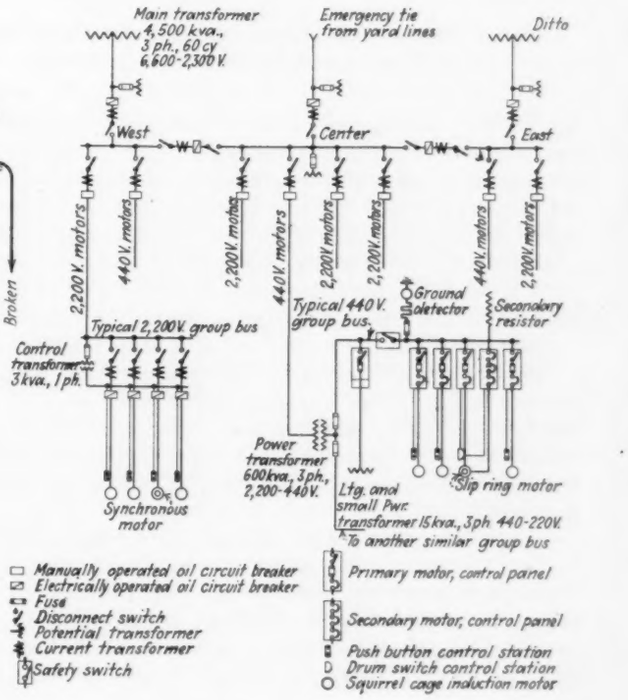
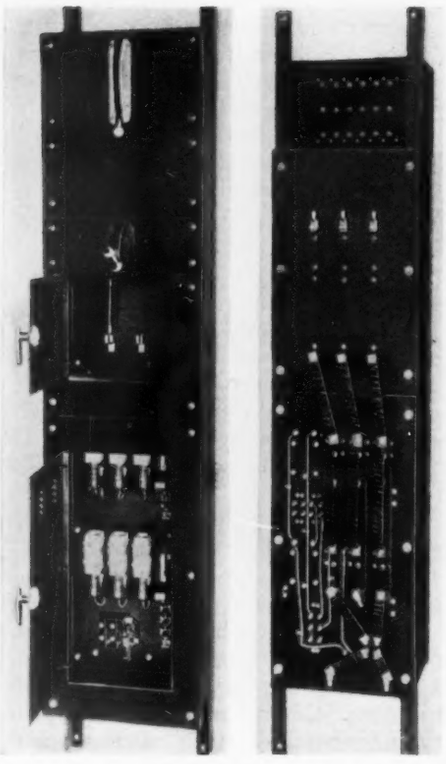


Fig. 1—Simplified flow diagram of breaker process

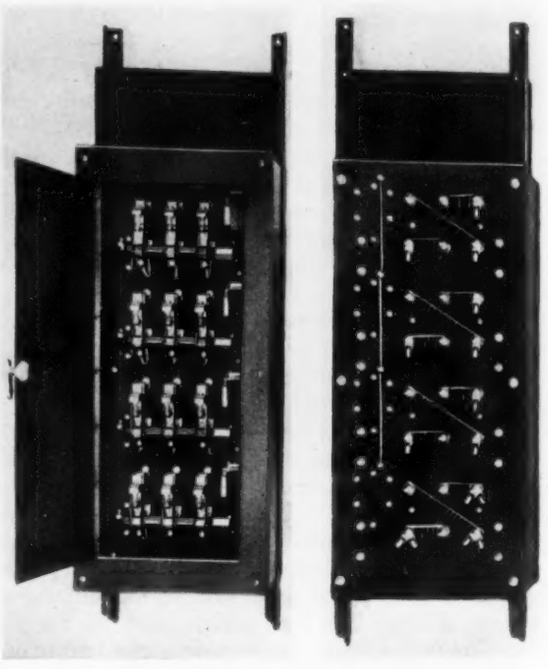
Fig. 2—Essential features of distribution system





Figs. 3 and 4—Primary and secondary control panels

Each primary panel consists of a knife switch, three N.E.C. fuses, a contactor and a thermal relay. The knife switch is front operated, quick break, arc snuffing and will interrupt at least 150 per cent of its continuous current rating. It is so selected with respect to motor rating that it can safely interrupt stalled rotor current. The fuses are selected for 200 to 300 per cent of motor rated current so as to withstand starting currents and overloads, but to promptly interrupt short circuits. The contactor is of specially heavy-duty design, with magnetic blow-out and chimney type arc chutes, and will interrupt ten times in 30 seconds a current of at least ten times its rating at 440 volts, 60 cycles, 0.4 power factor. Each contactor is provided with a newly developed auxiliary switch, with from one to six contacts, which can be easily assembled either to close or to open when the contactor closes. The thermal relay is of standard design arranged to reset itself automatically on cooling after a trip-out.



Each secondary panel consists of a number of two-pole or three-pole contactors as required, each similar to the primary contactors described.

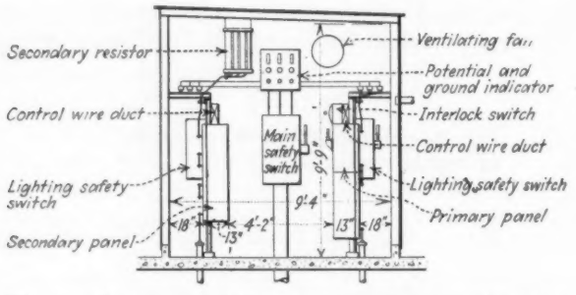


Fig. 5—Section of 440-volt control room showing switchboards and equipment on end wall

the primary panels are of cable insulated with varnished cambric and covered with asbestos braid. This open bus arrangement permits any grouping of the panels, which were manufactured in three standard widths. The main safety switch disconnects the entire bus from its source of supply. The potential and ground indicator consists of three fuses, three resistors and three 2-watt neon glow lamps, connected permanently to the bus.

Interlocks—Every process of this kind which handles a continuous flow of material requires some means of preventing a pile-up of material should one or more machines suddenly stop for any cause. In this breaker, where in some locations a ton of coal passes every 2½ seconds, it is at once realized that an automatic interlock is needed.

The scheme used is in principle extremely simple, the holding circuit of each motor contactor being completed through an auxiliary switch on the contactor of the next motor beyond. Where machines stand parallel in the line of flow parallel interlocking is used. Where manually operated gates divert the coal from one machine to another throwover switches are provided on the gate automatically to divert the interlock also.

Most of the interlock wiring is merely from panel to panel in the 440-volt control rooms. All wires from a control panel to any other panel pass through the double-throw interlock switch at the top of the panel, so that when the switch is in the mid-position all possible feeds from other sources are disconnected. When working on a motor circuit the operator may completely isolate the circuit and its control from all sources of supply or back-feed by opening the main switch and the interlock switch of the panel. The up position of the interlock switch interlocks the motor with the preceding and following motors. The down position isolates the motor from the interlock and completes its own control circuits so it can be run independently for testing or adjusting.

Factors affecting the selection of the motors and control, data on more than 50 power applications, how the coal level in bins is electrically indicated and the method of electrically controlling the trapping cycle necessary with cones will be discussed in a subsequent issue.

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Operating Industrial Plant in Parallel with Purchased Power

Many industries using process steam have automatic back-pressure bleeder turbines with generators in parallel with outside sources of power supply. If the latter is interrupted the bleeder turbine will be overloaded and fail to maintain frequency unless some means is used to prevent this. At one foreign installation where such a turbine bleeds to the digesters at 125 lb. and exhausts to the paper machine at 25 lb. S. H. Hemen-

way, Westinghouse Electric & Manufacturing Company, reports* that an electrical pilot switch is installed in the incoming power line so that, in the event of failure of the outside power source, the turbine is not only disconnected from the board, but the circuit breakers on all but the essential load, viz., paper machine drive and its auxiliaries, are opened. This brings the total load within the capacity of the turbine. The pilot switch also energizes a solenoid on the turbine automatic back-pressure control change-over valve, which shifts the turbine from back-pressure bleeder control, floating on the line, to bleeder speed responsive control, maintaining the system frequency on the essential load. After this change-over the frequency is held within close limits by means of the governor speed compensator.

Before the Technical Association of Pulp and Paper Industries, New York City.

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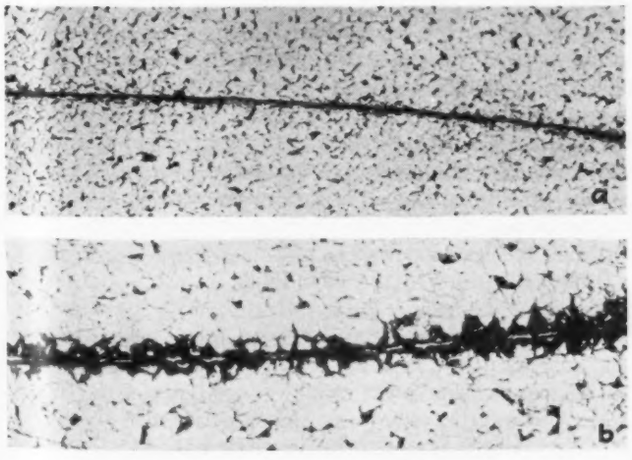
Electricity Welds in Unique Way

An automatic continuous-type hydrogen-filled electric furnace is being used by the Bundy Tubing Company, Detroit, to "weld" iron or steel parts that may be preassembled with a snug fit either by inserting one part in the other or by spot welding or pinning the parts in intimate contact. Copper, either in the form of copper wire or copper paste, is applied to the joint and the assembly gradually brought to a maximum temperature of 2,100 deg. F., in the reducing atmosphere of the furnace which is used to avoid oxidation of the surface.

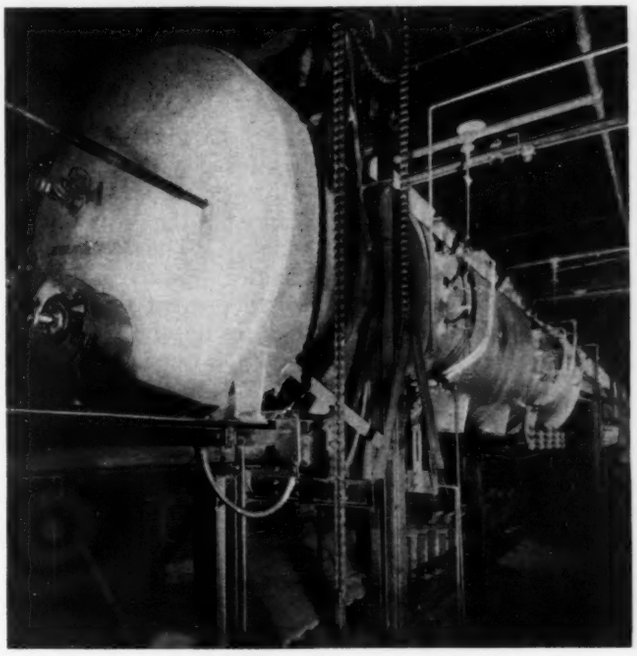
Under these conditions, T. M. Rude, assistant general manager of the company, reports, the copper is melted and drawn by capillary attraction into the seam where the iron and copper form an alloy (approximately 97 per cent iron and 3 per cent copper). He claims that the parts are not merely brazed or soldered together, but actually welded as no free copper remains between the parts (see photomicrograph).

Regarding the strength of such joints, it is reported that: (1) A steel tank assembled from a length of tube, two stamped end plates and a fitting, all joined by welding, burst at 2,100 lb. hydraulic pressure without the joints failing; (2) two pieces of $\frac{5}{8}$-in. bar stock were joined by a 45-deg. scarf "weld" and when subjected to a tension of 66,000 lb. per square inch the steel failed without rupturing the joint; (3) a round steel pin, inserted in a drilled hole in a piece of steel and welded, failed in torsional shear without rupturing the bond.



Before and after welding

(a) Note sharply defined grain boundaries before welding.
(b) The copper-iron alloy (black area) formed by process extends back into grain structures.



Continuous electric furnace discharges car of welded parts every four minutes

The assemblies welded are in the furnace about 45 minutes. The welding temperature of 2,100 deg. F. is maintained by several banks of resistors in the furnace. No current is conducted through the welded parts themselves.

Heat treating offsets the annealing action of the process and relieves any stresses set up by previous processing without affecting the joint itself, Mr. Rude declares. He maintains that the latter further indicates that the bond is not copper, but a copper-iron alloy with a melting point practically that of steel.

One of the most important advantages claimed for the process is its economy, due to the continuous nature and the savings in material and labor in producing the integral parts welded. For instance, a fan pulley originally machined from an intricate casting was supplanted by a welded assembly made up of two simple stampings and a bushing. A header for a multiple refrigeration installation was assembled by welding together a length of tube, stamped end plates and fittings which jointly take the place of a network of copper tubing and brass fittings. Small crankshafts, camshafts, spring shackles, levers, etc., which would ordinarily be machined from expensive parts, may be produced by welding together inexpensive stampings, bar stock, drawn shapes, etc.

"No assemblies seem to be too intricate for this process if the parts can be fitted together with good contact and there is a chance to apply copper in some form at or near the joint," Mr. Rude declares.

This Matter of Quality in Appliances

By EARL WHITEHORNE

The New Richmond ordinance again emphasizes the need to glorify quality in the electrical market.

RICHMOND, VA., has a new city ordinance. It became effective on March 15, replacing an old ordinance, that was very restrictive but was not rigidly upheld. The new ordinance is apparently to be vigorously enforced. Notice has been given. Weekly inspections of domestic appliances for sale in retail stores have been instituted. And local dealers believe that the chief inspector of the city will carry out the provision of the new law thoroughly and honestly. Thus Richmond takes its place among 40 communities—mostly in the far West—that now have legislated to prevent the sale of domestic electrical appliances that are unsafe.

The Richmond ordinance carries the usual provisions:

1. Journeymen electricians must pass an examination and be licensed.
2. So must the contractor.
3. The use of flexible conduit, metal molding, or other raceways, is allowed in old buildings or in homes above the basement, where rigid conduit or armored cable is required.
4. All electrical materials, devices and appliances must conform to the standard of the Underwriters' Laboratories, Inc., as indicated by lists of inspected appliances or with the regulations of the National Board of Fire Underwriters or with other standards approved by the American Engineering Standards Association or by the United States Bureau of Standards.
5. Every person offering such materials or appliances for sale must determine that these appliances conform or suffer a penalty.
6. The chief inspector is empowered to grant provisional approval of equipment which in his judgment is "reasonably safe" where no applicable rules or specifications have been made.
7. Old buildings shall be reinspected and defective work condemned.

And there you are. Theoretically it is a fine idea. Practically they are up against a lot of knotty problems of administration.

Regular inspection

The purpose of this ordinance, aside from enforcing safe methods of electrical construction, is to prevent the sale of cheap and hazardous toasters, grills, heating pads and other appliances carried by many drug stores, chain stores and mail order houses. Inspectors are now visiting the dealers' stores each week, checking the stock against the list of approved equipment and condemning sub-standard stuff. Where an appliance is not on the approved list, yet apparently safe, the inspector passes it as reasonably safe under the authority given him.

Since the city has no testing laboratory this becomes a matter of opinion and, of course, opens up a wide opportunity for irregularity and graft. The utility and the electrical dealers realize this, but they welcome the experiment because it looks like a chance to curb the sale of shoddy merchandise that is being sold in large quantity by the bargain stores. Some of these appliances are themselves unsafe. Most of them are wired with unsafe cords that soon fray out and cause a short circuit, and blow a fuse. The customer then too often lays the device aside on the shelf in disgust and that hurts all electrical appliances in that household.

While this ordinance stresses safety, some aspects of the inspection bring up again the whole question of quality in appliances on which there are two schools of thought. Some say that appliances should be tested for safety only and others claim that it would be in the public interest to test for quality and insure that devices sold for use on electric circuits give a fair measure of economy and service. One involves police power for the protection of the public. The other would seem to be a matter of industry policy.

Two objectives

No one will question the importance of restricting the sale of hazardous appliances. If they are so poorly made that there is risk of bodily injury to the user or danger of fire, merchants should not be permitted to sell them. As a matter of fact, there is little evidence that the hazard is very large. Deaths from electricity occur mostly in bathrooms, where some one stands in the bathtub and turns on a light when the fixture is short circuited, or touches a radiator and a water pipe at the same time. There is comparatively little record of fire or injury from the use of small cooking and heating appliances. Such risk as there is, of course, should be safeguarded. It is a policing job that the industry should encourage in every way.

The question of testing appliances for quality goes beyond this, however, and advocates the protection of the public against the loss and disappointment that comes when an appliance costs too much to operate or fails to stand up properly. It aims to insure the electrical industry against the harm it suffers, when such appliances destroy public confidence. And this is something quite outside of the usual purpose of inspection, in Richmond for example. But it is something of very practical importance to electrical men.

It is to the glory of the automobile industry that people everywhere say today "All cars are good!" And they are. Some may be more luxurious or more efficient than others. But there is a high quality standard in all cars that guarantees the buyer money's worth and satisfaction. It has become the very basis of competition in the motor car field. But it is not so in the electrical industry. For under test electric flatirons, toasters, percolators and other devices and the cords that connect them to the circuit have a very wide range of efficiency in terms of speed and consumption that bears little relation to their

price. In other words, there is no guide today to actual worth.

Some power company men advocate a system of efficiency ratings to be placed upon all appliances sold that will indicate their relative merit in terms of general utility value. The manufacturers have resisted this suggestion, believing that quality in electric toasters should not be policed any more than quality in overcoats or shoes. They say that the purchaser should be free to buy what he desires, knowing that, in the main, the lower the price the lower the quality. But in his perfectly natural defense of his present methods and his present standards, it seems to me that the manufacturer overlooks one point that is vital to the electrical industry right now. I mean the good name of the electrical appliances used by women.

In the early days all these devices—toasters, grills, percolators, waffle irons, flatirons and the rest—were high-priced products. They were highly engineered. The pride of the electrical man was built into them. They were sturdy and safe. They were likewise expensive. The factory designed them and set the price that the salesmen were to ask. But those days are gone forever. These appliances today are largely built for the market and the emphasis for a long time has been on price. The public knows what they cost, but hears nothing about how well, how quickly and how economically they do their work nor how long they last. Appliance advertising and appliance selling have degenerated largely into a contest between prices on different levels.

More critical buyers

But the public is not satisfied with this condition. There is an increasing demand from the housewives of America for facts as to the reliability and efficiency of all kinds of domestic equipment. It is this popular demand that is being answered by the Good Housekeeping Institute, the National Retail Dry Goods Association, Consumers Research, Inc., and several leading department stores that have established laboratories or testing services. This demand springs from the growing realization that it is not safe to buy electrical devices or washing powders or many other household supplies for price alone.

But testing appliances and rating them for quality will not in itself cure this condition. Making them even cheaper to buy will not correct it. Nothing will increase the public interest in quality and give it importance in the appreciation of the women who buy these things but the glorifying of that quality by the manufacturer himself, in his product, in his advertising and in his selling. When the emphasis is placed squarely in quality the interest will center in quality. When the proved value of a device in terms of its good performance becomes the pride and the boast of its maker it will be recognized and evaluated.

The first step in this direction will naturally have to be some system of quality testing whereby quality can be defined and demonstrated. It must be made possible to identify quality before people can be expected to take much interest. But once it is made easy to find out which toaster or which flatiron gives the best service and the longest life at the least cost people will welcome the information and act on it. And the manufacturer of good appliances will be able to merchandise this quality for what it is worth.

There will be many more ordinances like the new one in Richmond, established to protect public safety. But there seems to be but one way to protect public confidence in electrical appliances. The manufacturer must insure them good value for their money, by making quality apparent and showing the buyer how to obtain it. No quality label nor no approval list can accomplish this alone. Quality in household equipment must be sold and delivered, like quality in motor cars.

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Tacoma Plant Estimated at $80 per Kilowatt

Tacoma's new 25,000-kw. steam plant, built to supplement Cushman hydro power during low-water periods, will cost about $80 per kilowatt, exclusive of real estate, according to A. F. Dorland, electrical engineer for the city. An itemization of the investment expected is tabulated. Pulverized coal, prepared in two unit pulverizers per boiler, will be burned in the furnaces, which are designed so gas or oil can be used if necessary. Two 1,650-hp. boilers, each capable of furnishing sufficient steam to operate the 25,000-kw. turbine at rated load, are installed. Steam is to be generated at 420 lb. and 750 deg. superheat. The turbine is a fourteen-stage unit bled at the third, seventh and eleventh stages for feedwater heating. Power is generated at 13,800 volts.

Itemized Cost of Tacoma Steam Plant No. 2

Engineering and superintendence	$106,674
Insurance	257
Interest, premium and discount	133,602
Miscellaneous expenditures	1,820
Plant	1,691,235
Work equipment	1,797
	$1,935,385

Distributed accounts (not including real estate)

	Amount	Per Cent of Total
Power plant building and fixtures	$429,851	22.2
Boiler plant equipment including stacks and breechings	427,005	22.0
Coal-handling, pulverizing and burning equipment	63,978	3.3
Ash-handling equipment	19,785	1.0
Feedwater equipment	37,486	1.9
Piping, fittings and valves	108,787	5.6
Instruments, including combustion control and associated electric equipment, but excluding electric switchboards	46,328	2.4
Steam power generating equipment	376,276	19.4
Condensing equipment	104,716	5.4
Switchboards, including instrument transformers, station battery and charger	28,949	1.5
Transformers	20,385	1.1
Switching apparatus	45,586	2.4
Wiring	37,878	2.0
Crane (75 ton)	17,189	0.9
Undistributed equipment	2,697	0.1
Shop, including miscellaneous small tools	3,956	0.2
Engineering, office and testing equipment	2,382	0.1
Total distributed accounts	$1,773,234	
Undistributed engineering and superintendence	28,549	1.6
Undistributed interest, premium and discount	133,602	6.9
Total undistributed accounts	$162,151	
Total construction accounts	$1,935,385	100
Estimated cost at completion, including testing and adjustments, under	$2,000,000	
Estimated cost per kilowatt (25,000 kw.) approximately	80	
or, per horsepower, about	60	

Termination of Control Cables at Switchboards

By W. B. MORTON
Electrical Engineering Division,
Philadelphia Electric Company

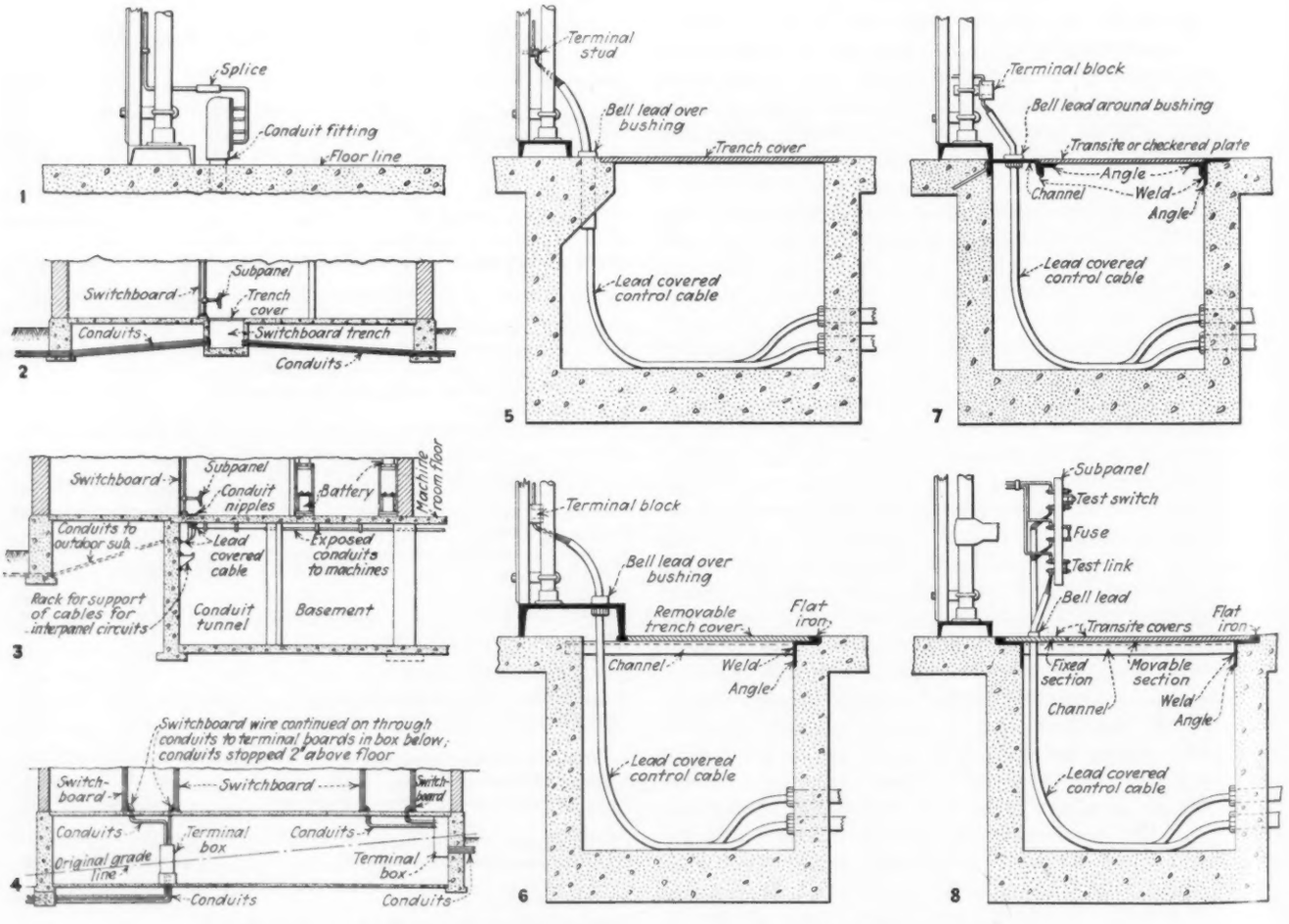
An important feature in station design which frequently receives insufficient consideration is the problem of terminating cables and conduits at the switchboard. While a simple arrangement similar to Fig. 1 will suffice for small stations, larger and more important installations justify a more flexible design which will accommodate changes in cable routing resulting from alterations in equipment layout and switchboard panel arrangement. The method shown in Fig. 1 makes no provisions for interpanel circuits and, moreover, changes in cable routing necessarily involve breaking into the floor.

Flexibility may be secured at a cost in keeping with the station as a whole by the addition of a cable trench, Fig. 2. Cable trenches vary in size from a foot or so square in section to those large enough to admit a man. In larger stations conduits may terminate in a tunnel, Fig. 3, partitioned off from the basement, while the largest stations often warrant the use of the entire room beneath the switchboard for cable terminal facilities, Fig. 4.

Cable trenches or tunnels extending the length of the switchboard provide adequate space for interpanel circuits and also permit the routing of cables to be changed as necessary without alterations in the conduit system. The size of trenches is determined by the number of cables required, but cable space ceases to be the determining factor if trenches are made large enough to admit a man.

Material for trench covers may be concrete, steel checker plate or transite. Either of the two latter materials is suitable, transite possessing the advantage of light weight. Since access is usually required to but a small portion of the trench, covers need not be larger than the switchboard panel width. This also reduces the weight of individual covers and renders them easily removable. Plain concrete edges are easily broken and curb angles cast in the trench top furnish a convenient and serviceable means of accommodating covers. For small trenches these curbs may be fabricated as units and shipped assembled; for larger trenches the curb angle frames may be made in sections. Frames fabricated by welding are the more substantial, but bolted frames are entirely practicable.

The circuits between trench and switchboard may be handled in several ways. In Fig. 5 conduit nipples are cast in one side of the trench. The cables may be passed



Figs. 1 to 8—Eight methods of terminating control cables at switchboards

through the switchboard base channel, Fig. 6, or through a smaller channel forming part of the curb assembly, Fig. 7. The method shown in Fig. 6 requires a base channel wider than normal and the methods in Figs. 5, 6 and 7 are all inflexible in that alterations are difficult to make. They also tend to become congested on switchboards having a large number of cables per panel. In Fig. 8 the cables pass through a fixed section of cover material which may be easily altered or even entirely replaced as conditions require.

Control cables vary considerably in size and, while openings may be designed to suit the cables planned for in the initial layout, the cables actually installed, because of subsequent changes in design, are liable not to fit. Lead sheaths may be belled over the conduit bushings or turned wooden plugs may be used, the latter being bored in the field to suit the cables sizes. Conduit fittings are not practicable with leaded cable and are seldom used except for the arrangement shown in Fig. 1.

For convenience in testing, terminal links, test switches or fuses are required at the junction of cables and switchboard wiring which are not provided in Fig. 1, where the switchboard wiring is soldered directly to the cable conductors. On simple control panels where the wiring is not congested terminal studs, Fig. 5, or terminal blocks may be used. Terminal blocks may be mounted directly upon the panel, Fig. 6, or, where panel space is limited, upon brackets, Fig. 7. On large switchboards the congested wiring is at best hard to trace, and the segregation of all fuses, terminals and test switches upon a sub-panel, Fig. 8, conserves space, facilitates testing and provides a satisfactory job at a reasonable cost.

Where terminal facilities are provided in the room below the switchboard a suitable arrangement is made by extending the switchboard wiring to terminal boards in boxes below the switchboard panels, as shown in Fig. 4. This latter scheme removes all of the terminating and testing equipment from the rear of the switchboard and leaves the base of the panels free from congested wiring.

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Air-Arc Power Rectifier for 150 Kv.

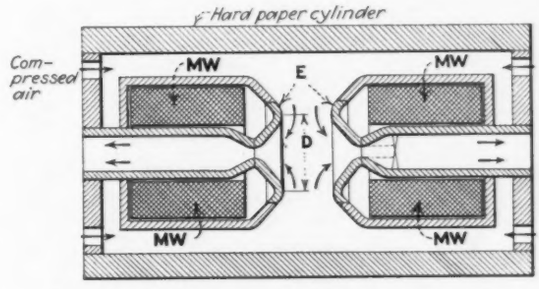
Efforts to rectify large amounts of power by means of a gap have in the past failed because the electrodes were burned by the arc, because the latter could not effectively be periodically extinguished and because such methods as were used to bring about the extinction—for instance, an air blast—caused excessive losses.

The successful overcoming of these obstacles is now announced, to the extent that serviceable arc rectifiers for very high voltages and large currents have actually been constructed and operated, although only in an experimental way. The achievement resulted from exhaustive researches in the high-tension laboratory of the Technical College at Brunswick, Germany, which led to the discovery of certain fundamental conditions governing the functioning of such a device.

As reported in an article in the *Elektrotechnische Zeitschrift* of August 4, 1932, by Erwin Marx, the rectifier consists essentially of two hollow cylindrical electrodes shown schematically in section in the illustration. For the sake of clarity the means adopted for cooling them are omitted from the diagram.

At the proper instant in the cycle a spark is made to jump between the electrode tips *E*. For this purpose an inductively coupled auxiliary circuit is used. It includes a spark gap between rotating and stationary contacts, the latter adjustable for timing the auxiliary spark, which sets up a high-frequency oscillation across the main gap, thus initiating the flow of the power current.

Burning of the electrodes at any point is prevented by compelling the power arc to revolve rapidly across the facing edges (perpendicular to the plane of the paper) while its length remains substantially constant. This, in turn, is accomplished by setting up a magnetic field with the aid of the windings *MW*. Meanwhile the arc is being driven toward the axis of the electrodes by compressed air forced through the device as indicated by the arrows.



Arc chamber for rectifying large currents at high voltage

For clarity, provision for cooling the electrode is omitted

Chilled and lengthened, and with its ends forced into the constricted throat where the flow of air is most rapid, the arc is blown out as the current approaches zero and cannot reignite. The device therefore acts as a one-way valve.

The dimensions of the apparatus are indicated in a discussion of some of the investigations into its operating characteristics. With a diameter, *D*, at the tips, of 35 cm. (13.8 in.) and at the throat, *d*, of 10 cm. (4 in.), and with air at a gage-pressure of 1.9 atmosphere (28 lb. per square inch) it was possible to rectify 180 amp. up to 130 kv. Both values are maxima. Other rectifiers were tested up to 1,500 amp. at 150 kv. The author states that there is nothing to prevent a further increase.

The reported over-all efficiency of conversion is remarkably high, 98-99 per cent, by measurement of losses. No measurable burning of the electrodes resulted during an eight-hour run at 55 amp. Connected for six-phase conversion, the smooth transfer of current from one valve to the next is revealed by oscillograms.

Finally, it is stated that the identical arrangement can be used for reconversion of direct to polyphase current. Since these arc rectifiers are simple and can be constructed far more cheaply than other converting apparatus, and since direct-current transmission lines can be built at less cost for a given amount of power than three-phase lines, the author foresees great future economies by using direct-current transmission.

World Statistics of Public Utility

To learn that in a number of foreign countries electrical output was larger in 1930 than in 1929 is somewhat of a surprise. We had our decrease; we were told that conditions in Europe were worse than in the United States, so a general decline in electrical production abroad was probably taken for granted by every one who gave the subject even a casual thought.

Comparable statistics for these two years, compiled and published by the International Union of Producers and Distributors of Electrical Energy, with headquarters in Paris, give a different impression. Comparing total production in 1929 and in 1930, we find percentage gains

Table I—Production of Electrical Energy in 1929

Country	Thermo-Electric Plants: Driven by Steam Engines and Turbines: Installed Capacity Thous. Kw. (1)	Output, Millions Kw.-Hr. (2)	Ave. Calorific Value of Fuels, Calories per Kg. (3)	Fuel Consumption, Calories per Kw.-Hr. (4)	Thermo-Electric Plants: Driven by Internal Combustion Engines: Installed Capacity Thous. Kw. (5)	Output, Millions Kw.-Hr. (6)	Ave. Calorific Value of Fuels, Calories per Kg. (7)	Fuel Consumption, Calories (8)	Hydro-Electric Plants: Run-of-Stream Plants: Installed Capacity Thous. Kw. (9)	Least Available Capacity, Thous. Kw. (10)	Energy Used to Fill Reservoirs, Millions Kw.-Hr. (11)	Energy Output Millions Kw.-Hr. (12)	Energy Available but not Utilized Millions Kw.-Hr. (13)	Plants at Storage Reservoirs: Installed Capacity, Thous. Kw. (14)	Energy for Storing, Millions Kw.-Hr. (15)	Energy Output, Millions Kw.-Hr. (16)	Total, Fuel and Hydro Plants: Installed Capacity, =1+5+9+14 Thous. Kw. (17)	Operating Peak, Thous. Kw. (18)	Energy Output, =2+6+12+16 Millions Kw.-Hr. (19)
Argentina (City of Buenos Aires)	.....	860	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	862
Austria (City of Vienna)	177	440	3.827	7,332	.....	.....	.....	.....	19	15	.....	87	.....	.....	.....	.....	196	160	527
Belgium	810	1,768	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	810	550	1,768
Bulgaria	38.2	27	4,500	.....	6.5	9.5	10,000	.....	26.3	.....	.....	48.5	.....	.....	.....	.....	71	.....	85
Canada	172	.....	.....	.....	Inc. in col. 1	.....	.....	.....	4,022	.....	.....	.....	.....	.....	.....	.....	4,194	.....	17,962
Czechoslovakia	561	1,010	3,600	.....	40	75	10,000	.....	63	.....	.....	133	.....	.....	.....	.....	664	.....	1,218
Denmark (April '29-Mar. '30)	202	.....	.....	.....	101	.....	.....	.....	12	.....	.....	.....	.....	.....	.....	.....	315	192	374
France	5,245	8,198	.....	.....	Inc. in col. 1	Inc. in col. 2	.....	.....	2,229	1,110	.....	6,121	.....	Inc. in col. 9	.....	Inc. in col. 12	7,474	.....	14,319[1]
Germany	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,495	.....	16,391
Greece	70	94	.....	.....	.....	.....	.....	.....	6	.....	.....	8	.....	.....	.....	.....	76	.....	102
Holland	777	1,690	7,000	6,000	3	Inc. in col. 2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	780	500	1,690
Hungary	452[2]	613	.....	.....	28[2]	60	.....	.....	4[2]	.....	.....	7	.....	.....	.....	.....	484[2]	.....	680
Italy	820	510	.....	.....	Inc. in col. 1	Inc. in col. 2	.....	.....	3,500	.....	.....	10,047	.....	Inc. in col. 9	.....	Inc. in col. 12	4,320	.....	10,557
Japan	1,069	1,735	6,480	5,420	13	15	10,000	3,470	1,638	965	.....	11,562	.....	908	98	Inc. in col. 12	3,628	2,507	13,312
Latvia	40	78	.....	.....	1.5	1	.....	.....	1.5	.....	.....	1	.....	.....	.....	.....	43	.....	80
Lithuania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	.....	17
Norway (1928-1929)	90	.....	.....	.....	.....	.....	.....	.....	1,600	.....	.....	.....	.....	.....	.....	.....	1,690	.....	10,000
Poland	657	1,714	5,435	7,738	41	51	.....	.....	16	.....	.....	20	29	.....	.....	.....	714	417	1,785[3]
Portugal	70	122	.....	.....	.....	.....	.....	.....	30	.....	.....	65	.....	.....	.....	.....	100	.....	187
Rumania	97	169	.....	.....	57	78	.....	.....	15	.....	.....	43	.....	.....	.....	.....	169	.....	290
South Africa[4]	206	801	6,940	5,270	.....	.....	.....	.....	1	.....	.....	4	9	.....	.....	.....	207	143	805[4]
Soviet Russia	.....	.....	.....	7,070	.....	.....	.....	3,430	.....	.....	.....	.....	.....	.....	.....	.....	1,263	.....	3,542
Spain	276	442	.....	.....	24	9	.....	.....	796	.....	.....	1,982	.....	.....	.....	.....	1,096	.....	2,433
Sweden[5]	490[6]	308	7,000	11,000	Inc. in col. 1	81	10,000	3,000	1,250[6]	.....	.....	4,593	.....	.....	.....	.....	1,740	.....	4,982
Switzerland	41	9	7,200	[7]	19	Inc. in col. 2	10,500	[7]	650	260	70	2,960	760	315	320	540	1,025	650	3,509
Tasmania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	67	54	358
Turkey (City of Constantinople)	48	65	6,620	5,340	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	48	20	65
United States	21,743	59,128	.....	.....	376	Inc. in col. 2	.....	.....	7,439	.....	.....	30,956	.....	Inc. in col. 9	.....	Inc. in col. 12	29,558	.....	90,084
Victoria (July '29-June '30)	120	346	4,800	6,800	.....	.....	.....	.....	17	17	.....	61	.....	15	.....	16	152	103	423

Production of Electrical Energy in 1930

Austria (City of Vienna)	210	390	3,520	6,890	.....	.....	.....	.....	20	15	.....	149	.....	.....	.....	.....	230	160	539
Belgium	1,068	1,962	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12	.....	23	1,080	615	1,985
Finland	239	328	.....	.....	9	4	.....	.....	220	.....	.....	854	4,500	.....	.....	.....	468	.....	1,186
France	5,800	9,000	.....	.....	Inc. in col. 1	Inc. in col. 2	.....	.....	2,300	1,150	.....	6,600	.....	Inc. in col. 9	.....	Inc. in col. 12	8,100	.....	15,600
Greece	71	120	.....	.....	.....	.....	.....	.....	7	.....	.....	10	.....	.....	.....	.....	78	.....	130
Italy	840	386	.....	.....	Inc. in col. 1	Inc. in col. 2	.....	.....	3,800	.....	.....	10,450	.....	Inc. in col. 9	.....	Inc. in col. 12	4,640	.....	10,836
Japan	1,071	1,493	6,480	6,200	15	15	10,000	3,020	1,728	997	.....	12,449	.....	1,084	103	Inc. in col. 12	3,898	2,499	13,957
Lithuania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11	.....	18
Poland	708	1,635	.....	.....	48	55	.....	.....	16	.....	.....	30	.....	.....	.....	.....	772	408	1,720[3]
Rumania	94	166	.....	.....	59	96	.....	.....	32	.....	.....	42	.....	.....	.....	.....	185	.....	304
South Africa[9]	226	951	6,900	5,100	.....	.....	.....	.....	1	.....	.....	5	.....	.....	.....	.....	227	156	956
Soviet Russia	.....	.....	.....	6,680	.....	.....	.....	3,350	.....	.....	.....	.....	.....	.....	.....	.....	1,780	.....	5,093
Switzerland	40	8	7,200	[7]	20	Inc. in col. 2	10,500	[4]	675	285	68	3,065	740	360	380	510	1,095	670	3,583
Tasmania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	378
Turkey (City of Constantinople)	50	73	6,640	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	22	73
United States	23,239	59,459	.....	.....	407	Inc. in col. 2	.....	.....	7,949	.....	.....	29,033	.....	Inc. in col. 9	.....	Inc. in col. 12	31,595	.....	988,42
Victoria (July '30-June '31)	131	297	5,200	8,400	.....	.....	.....	.....	17	.....	.....	72	.....	15	.....	48	163	108	417

[1]Total includes some energy utilized directly by mining and electrochemical industries without going into utility net-works and which cannot be segregated from the total production.

[2]These quantities are expressed in thousands of kilovolt-amperes.

[3]Includes a certain amount of energy used directly by industries that sell only occasionally. Also includes energy for power plant auxiliaries, amounting to 4.5 or 5.0 per cent.

[4]Includes only plants of the "Electricity Supply Commission." For operations from July 1, 1928, to June 30, 1929, the total production for South Africa (Cape, Transvaal, Orange Free State) was 2,300,000,300 kw.-hr.

[5]Includes output of private industrial plants.

[6]Approximately.

[7]Fuel-burning plants are rarely used, and only at load peaks; that is, under unfavorable conditions as to efficiency.

[8]Tentative figures.

[9]Includes only plants of the Electricity Supply Commission, producing about 35 per cent of the total energy used in the Union of South Africa.

Energy Output and Use

in the more important countries listed for both years as follows:

Belgium, 12; France, 9; Japan, 5; Rumania, 5; Italy, 3; Switzerland, 2. Soviet Russia has the remarkable increase of 44 per cent; Greece gained 28 per cent; Poland shows a loss of 4 per cent.

Unfortunately, for several countries of primary importance statistics are either inadequate or entirely absent. Data regarding Great Britain and Germany, for example, are essential in any listing of world-wide or even of European statistics alone.

Per capita use of electrical energy varies widely. The population figures given are only approximate and so do not permit of close comparison. However, Norway stands at the top with about 3,600 kw.-hr. annually per capita, Canada follows with 1,800, Switzerland with 865, or 18 per cent more than the United States. France, Italy, Holland, Belgium and Japan range from 350 to 200. Countries undeveloped industrially are low—for instance, Rumania, with 16 kw.hr. annually per capita.

Table II—Transmission and Distribution of Electrical Energy in 1929

Country	Population		Energy Delivered to Systems				Energy Furnished by Systems for Consumption					
	Total Population Millions (20)	Population Served Millions (21)	Produced in the Country Millions Kw.-Hr. (22)	Imported Millions Kw.-Hr. (23)	Exported Millions Kw.-Hr. (24)	Total for Consumption in the Country = 22 + 23 — 24 Millions Kw.-Hr. (25)	For Traction Millions Kw.-Hr. (26)	Elec.-Chem, Met. & Similar Millions Kw.-Hr. (27)	Other Industries Millions Kw.-Hr. (28)	Public Service Domestic, Com'l Millions Kw.-Hr. (29)	Total = 26+27+28+29 Millions Kw.-Hr. (30)	Losses = 25—30 Millions Kw.-Hr. (31)
Argentina (City of Buenos Aires)	3	.....	862	.....	.....	862	.....	.....	.....	.....	.....	.....
Austria (City of Vienna)	2	2	526	.....	.....	527	101	302	302	302	403	124
Belgium	8	7.8	1,768	.....	6	1,762	100	Inc. in col. 28	1,322	188	1,610	152
Bulgaria	5.8	1.1	85	.....	.....	85	5	.....	43	22	70	15
Canada	9.9	.....	17,962	6	1,444	16,524	.....	.....	.....	.....	.....	.....
Czechoslovakia	14.7	9.3	1,218	20	.....	1,238	.....	.....	.....	.....	1 136	102
Denmark (April '29-March '30)	3.5(1)	3.5	374	73	38	409	22	318	318	318	340	69
France	41	36	14,319	621	135	14,805	904	2,841(2)	6,837(3)	2,227	12,809	1,996
Germany	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Greece	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Holland	7.8	7.6	1,690	4	.....	1,694	137	.....	958	480	1,575	119
Hungary	8	2.7	697(4)	.....	.....	697	91	Inc. in col. 28	306	163	560	137
Italy	41	38	10,557	243	.....	10,800	720	1,250	5 200	930	8,100	2,700
Japan	63	63	13,312	.....	.....	13,312	.....	.....	.....	.....	.....	.....
Latvia	1.9	0.8	80	.....	.....	80	10	.....	36	21	67	13
Lithuania	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norway	2.8	0.8	10,000	.....	.....	10.000	60	6,800	640	1,700	9,200	800
Poland	30.7	7.9	1,785	47	3	1,829	67	479	859	198	1,603	226
Portugal	5.8	.....	187	.....	.....	187	40	8	60	44	152	35
Rumania	17.6	4.4	290	.....	.....	290	.....	.....	.....	.....	243	47
South Africa(5)	.....	.....	805	.....	.....	805	140	16	547	94	797	8
Soviet Russia	.....	.....	3,542	.....	.....	3,542	201(6)	Inc. in col. 28	1,728(6)	427(6)	2,356(6)	307(6)
Spain	22.3	.....	2,433	.....	.....	2,433	196	Inc. in co. 28	1,439	344	1,979	454
Sweden(7)	6.1	5.6	4,982	40	80	4,942	222	1 117	2,495	530	4.364	578
Switzerland	ab't 4.05	ab't 4	3,510	30	1,040	2,500	210(8)	450(8)	1,340(8)	500(8)	2,500(8)	ab't 20%
Tasmania	0.2	0.1	358	.....	.....	358	.....	.....	.....	.....	.....	.....
Turkey (City of Constantinople)	0.7	0.3	65	.....	.....	65	10	.....	27	19	56	9
United States	122	84	89,315(9)	962	.....	90,277(9)	5,604	.....	44,326	25,329	75,295	14,982
Victoria (July '29-June '30)	1.8	1.1	449(10)	.....	5	444	41	8	177	164	390	54

Transmission and Distribution of Electrical Energy in 1930

Austria (City of Vienna)	2	2	539	.....	.....	539	100	305	305	305	405	134
Belgium	8.06	7.81	1,985	2	13	1,974	125	Inc. in col. 28	1,473	206	1,804	170
Finland	3.6	2.08	1,186	.....	.....	1,186	12	204	762	94	1,072	114
France(11)	41	36	15,600	700	150	16,150	1,000	2,900	7,600	2,550	13,950	2,200
Greece	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Italy	41	38	10,836	164	.....	11,000	820	1 350	5,080	950	8,200	2,800
Japan	63	63	13,957	.....	.....	13,957	.....	.....	.....	.....	.....	.....
Poland	31.1	8	1,720	14	16	1,718	70	276	889	205	1,440	278
Rumania	18	.....	304	.....	.....	304	.....	.....	.....	.....	257	47
South Africa(5)	.....	.....	956	.....	.....	956	130	18	624	118	890	66
Soviet Russia	.....	.....	5,093	.....	.....	5 093	261(12)	Inc. in col. 28	2,773(12)	689(12)	3 723(12)	413
Switzerland	ab't 4.05	ab't 4	3,580	25	1,020	2,585	225(8)	460(8)	1,400(8)	500(8)	2,585(8)	ab't 20%
Tasmania	.....	.....	378	.....	.....	378	5	Inc. in col. 28	290	66	361	17
Turkey (City of Constantinople)	0.7	0.45	73	.....	.....	73	10	.....	33	19	62	11
United States	124	84	87,984(13)	1,096	.....	89,080	5,534	Inc. in col. 28	11,021	28,084	74,639	14,441
Victoria (July '30-June '31)	1.8	1.1	449(14)	.....	4	445	47	5	157	167	376	69

[1]Census of July 1, 1928.

[2]Includes 1,500,000,000 kw.-hr. utilized directly without going through the net-work.

[3]Includes some energy used directly by the mining industry without going through the network, that could not be separated from the total.

[4]Includes 6,000,000 kw.-hr. from plants shut down during the year and 11,000,000 kw.-hr. to utility networks from private plants.

[5]Includes only plants of Electricity Supply Commission producing about 35 per cent of all energy used in South Africa.

[6]Allocation of energy from regional plants, say 2,663,000,000 kw.-hr. excluding output from municipal plants, say 879,000,000 kw.-hr., of which the allocation is not known.

[7]Statistics include private plants.

[8]Including losses.

[9]Obtained from Column 19 (Table I) plus 1 711,000,000 kw.-hr. from companies that do not distribute, less 2,480,000,000 kw.-hr. consumed by distributing companies for their own uses.

[10]Includes 17,000,000 kw.-hr. sold to private industries by the State Electricity Commission and 9,000,000 kw.-hr. of by-product energy from an industrial plant.

[11]Tentative figures.

[12]Allocation of energy from regional plants, say 4,136,000,000 kw.-hr., excluding output of municipal plants, say 957,000,000, allocation is not known.

[13]Obtained from column 19 (Table I) plus 2,025,000,000 kw.-hr. from companies that do not distribute, less 2,533,000,000 kw.-hr. consumed by distributing companies for their own uses.

[14]Same as note [10], with figures changed to 18,000,000 kw.-hr. and 14,000,000 kw.-hr.

Synchronous Condenser Raises System Generating Capacity

The Bangor Hydro-Electric Company has solved an interesting problem in system operation by purchasing a condenser for installation in its Veazie generating station, an important load and interconnection center feeding the city of Bangor and adjacent territory. The steadily growing load of the Bangor district exceeds the capacity of Veazie alone, now about 6,500 kva., and calls for considerable load transfer from adjacent sources. Under peak load and emergency conditions the energy transfer over one tie line in particular far exceeds the capacity for which the circuit was originally designed and produces serious disturbance of voltage levels in several important load areas. The voltage is further adversely affected by the fact that under different load conditions the direction of power flow on this tie line is reversed. At the same time exciters and Tirrill regulators reach their operating limits and the system becomes unstable under short-circuit.

Reconstruction of the overloaded tie line would have cost more than $150,000 in addition to the expense of substation changes necessitated by an increase in voltage. The installation of load-ratio equipment would have compensated for the excessive voltage drop on the tie line without producing any further benefits, but owing to the non-standard voltage ratios involved the equipment would have had a short economic life and would have cost at least as much as the solution adopted.

An alternative was to increase the capacity of the Veazie station, as a vacant flume was available in which a 1,000-kva. hydro-electric unit might have been installed at a cost of about $35 per kva. If this were done the new unit would reduce the demands on the overloaded tie line and permit postponing the rebuilding of the line. At this point the advantages of a synchronous condenser were considered. Owing to improvements in hydraulic conditions during the past two years it has become possible to load the generators with kilowatts up to the limit of their kva. rating, but load conditions made it necessary arbitrarily to limit the output of the waterwheels in order to keep the current in the generator windings within safe limits. In other words, the wattless current inherent in the local load reduced the capacity of the generators below that of their prime movers.

It was found that a 5,000-kva. condenser would cost no more to install than the 1,000-kva. hydro-electric generating unit and that it would raise the power factor from 80 per cent to unity of the load now being carried by the Veazie generators. Operation at unity power factor would remove the arbitrary load limit and release from 1,200 to 1,500 kw. additional capacity without the installation of any additional generators. In effect, the installation of the synchronous condenser will increase the system capacity from 1,200 to 1,500, depending on water conditions, at a cost of from $29 to $33 per kilowatt of added capacity. In addition to producing this low-cost energy, the condenser, by absorbing the wattless current of the district load, will relieve the transmission system and thereby improve system voltage and reduce transmission losses, also easing the burden on exciters and voltage regulators in several generating plants. It improves system stability and increases the ability of Veazie station to clear short circuits with speed and precision. The condenser is provided with continuous voltage starting and can be operated on either the main or auxiliary 6,900-volt bus, or both in parallel.

Commenting on this installation, President Edward M. Graham of the Bangor company stated to a representative of the ELECTRICAL WORLD:

"In the light of probable future developments the proposed new generator would probably have been retired from plant long before the expected economic life of such a unit had expired. Irrespective of the trend of future events, the synchronous condenser will be useful and serviceable as long as it can function. We feel that, considering all the circumstances, the condenser is giving us the most for our money and that it is particularly advantageous for us to make the installation at this time."

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READERS' FORUM

Believes River Power Will Not Reach Metropolis

To the Editor of the ELECTRICAL WORLD:

Your editorial entitled "Rates, Sales, Dreams—St. Lawrence" in your March 18 issue follows the crude popular manner of treating the St. Lawrence power issue. It is really not necessary to consider New York City at all, because "up-state" could very likely absorb generation from an additional 1,000,000 hp., which means only about 600,000 kw.

In 1931 New York State had a hydro-generating capacity of about 1,138,000 kw., generating about 5,254,000,000 kw.-hr. This means a plant factor of about 53 per cent; *i.e.*, all the waterwheel generators in the state, including all the junk, were running on the average at 53 per cent of full load all the time. This plant factor is high.

A plant factor of 53 per cent, even for water power, can only be the result of brute force economy under emergency conditions, and cannot safely be kept up for many years to come. Comparing the results of other hydro states (California 34 per cent, Washington 41 per cent, for example) it can be assumed that 40 per cent is a rationally satisfactory plant factor for all the water power of a great state like New York. Practically all the energy from water power in New York is now consumed up-state, and in addition up-state New York consumes some energy imported from Canada. Even without additional load and without replacing the importation by generation, a plant factor of 40 per cent would call for an additional hydro-generating capacity of approximately 420,000 kw. With a comparatively small amount of additional load, and without considering 3,000-kw.-hr. homes or anything else that you call dreams, up-state New York within a reasonably short time should be able to absorb the generation of 600,000 kw. additional hydro.

The discussion would therefore be simplified considerably if it were confined to up-state. I assume that the Power Authority knows all this and that it only brought in New York City in order to include all possible theoretical possibilities.

New York, N. Y. M. M. SAMUELS.

Men of the Industry

Muir Assumes New Duties With General Electric

Roy C. Muir, for the past three years assistant to the late Charles E. Eveleth, vice-president in charge of engineering of the General Electric Company, has just been appointed manager of the company's engineering department. In this new position Mr. Muir will have direct charge of the company's designing engineering in all of its various plants, the works laboratories and the general engineering laboratory at Schenectady. He has been associated with the General Electric organization for 28 years, and during that period of time his engineering experience has

covered a wide range of applications and developments, including three years as chief commercial engineer of the International General Electric Company.

His first assignment with General Electric, following graduation from the University of Wisconsin, his native state, was on the test, subsequently being transferred to the central station engineering department and then to what was at that time the power and mining —now industrial—engineering department, where he acquired valuable experience in an exceedingly wide field. As a result of this extensive training he was appointed chief commercial engineer of the International General Electric Company when it was organized in 1919 and during the three years he occupied this position he gained a knowledge of engineering practices as carried on in all the large countries of the world. In 1922 he was named assistant engineer of the industrial engineering department, being responsible for application engineering in all types of industries. It was in the spring of 1930 that Mr. Muir left the industrial engineering department to become general assistant to Mr. Eveleth, in charge of general administration of designing engineering departments and works laboratories.

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CHARLES F. NORTON of Howell, Mich., has resigned as vice-president and general manager of the Howell Electric Motors Company.

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LAURENCE K. CALLAHAN has been elected a member of the board of directors of the Indiana Hydro-Electric Power Company, Indianapolis, to succeed Ernest Van Arsdel.

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C. H. CHAMPLAIN has been appointed general works manager of the Westinghouse Electric & Manufacturing Company after 35 years of experience in managing factory operations in various cities for that organization. In his new position Mr. Champlain will supervise the management and operation of the nation-wide plants of Westinghouse.

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CHARLES S. BANGHART, for the past four years vice-president and general manager of the Metropolitan Edison Company, Reading, Pa., has been elected president of that company and of the New Jersey Power & Light Comany, succeeding R. D. Jennison of New York. The companies are in the Associated Gas & Electric System. Before becoming identified with the Pennsylvania properties of Associated Mr. Banghart was vice-president and general manager of the Staten Island Edison Corporation, also a unit of the Associated system.

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H. P. CHARLESWORTH, vice-president of the Bell Telephone Laboratories, has resigned to become assistant chief engineer of the American Telephone & Telegraph Company. Mr. Charlesworth is president of the American Institute of Electrical Engineers. Dr. E. H. Colpitts, who was appointed to succeed him, is assistant vice-president of the American Telephone & Telegraph Company in charge, under Dr. F. B. Jewett, vice-president, of that company's development and research department. Dr. Colpitts will continue to retain that office while serving as vice-president of the laboratories, in which capacity also he reports to Dr. Jewett, who is president of the laboratories.

•

FRANKLIN H. NICKERSON, vice-president of the Consolidated Gas Company, and ROBERT B. GROVE, vice-president of the New York Edison Company and of the United Electric Light & Power Company, have been elected to the directorate of the Brooklyn Edison Company. Mr. Nickerson has been with Consolidated Gas since 1897 and has been active in its accounting and technical organizations. As vice-president of the company he is in charge of finances and statistics. Mr. Grove is nationally known in the electrical industry through his committee work in the National Electric Light Association and his activities in connection with the annual conventions of that association.

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OBITUARY

LOUIS PROPP, electrical engineer and a director of the Noma Electric Corporation, New York, died suddenly in that city March 23. It was seven years ago that Mr. Propp and associates organized the Noma Electric Company to manufacture decorative lighting sets.

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HARRY N. GOODELL, western district manager of the Graybar Electric Company, died March 19, at his home in Kansas City, Mo., after an illness of several months. He was in his fifty-fourth year. With the exception of a few years of service as a railroad clerk, Mr. Goodell spent his entire business career with the Western Electric Company and with Graybar.

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EDGAR M. WILLIAMS, vice-chairman of the finance committee of the United Light & Power Company, died in New York March 22, after an illness of six weeks. Mr. Williams was formerly identified with various express companies in an executive capacity. At the time of his death he was a director of many corporations, including the United Light & Power Company, American Light & Traction Company and the Continental Gas & Electric Company.

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NORMAN MARSHALL, owner of the Elastoid Fiber Company, Waltham, Mass., and well known in New England electrical engineering circles because of his inventive activities, died at New York City, March 28, at the age of 69. He was a native of Hampstead, N. H., was educated at the Worcester Polytechnic Institute and was associated with the late Dr. Louis Bell during the World War in the development of a system of ultra-violet signaling for use at the front. He retired from business in 1927.

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VINCENT GOLDTHWAITE, formerly treasurer of the Attleboro Steam & Electric Company, director of the Weymouth Light & Power Company and for many years prominent in Massachusetts public utility financing and management circles, died at his home in Wellesley, Mass., March 9 as a result of a fall. He was born at Boston in 1872. His early business career included a connection with the American Steel & Wire Company as traveling

representative, after which he entered the utility field in association with the late John Joyce. From 1920 to 1930 he was a partner in the investment banking house of T. C. Fales & Company, Boston, and since retiring from that organization had conducted an independent securities business at the same location.

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CHARLES DAVID, well-known French electrical engineer, died recently in Paris, at the age of 58. Mr. David was for many years connected with the Laboratoire Centrale d'Electricité in Paris, where he carried out some valuable research work on the heating of electric cables under tension.

•

PERCY H. UNDERHILL, associated with the Stone & Webster Engineering Corporation since 1916 in design work and more recently in industrial and public utility appraisals, died at Allston, Mass., March 19 at the age of 49. He was identified with structural engineering design on the Conowingo and Osage hydro-electric projects in addition to other engineering undertakings.

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G. W. MALCOLM, well-known British electrical engineer, who was actively connected with the administration of a number of industrial undertakings, died recently at Northwich, England, at the age of 62. Mr. Malcolm was managing director of the Salt Union, chairman and managing director of the Mersey Power Company, a director of the British Power & Light Corporation, Ltd. (1929), and of the Electrical Distribution of North Wales and district and chairman of the North Wales Power Company. He was also chairman of the Chemical Employers' Federation and of the Joint Industrial Council for the Chemical Trade. Mr. Malcolm was a member of the Institution of Electrical Engineers and of the Institution of Mechanical Engineers.

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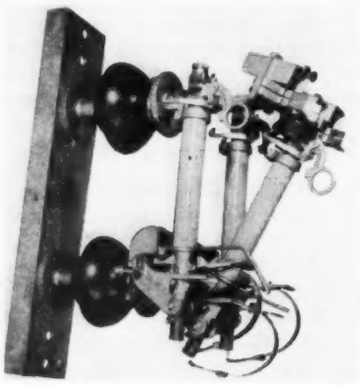
E. L. KIRK, vice-president of the Sioux City Service Company, Sioux City, Iowa, died April 4. Mr. Kirk had been associated with the utility industry in Sioux City for 43 years. When the Sioux City Service Company was organized in 1904, by the Armour and Swift interests to combine the local utilities, he was serving as vice-president of the Sioux City Traction Company. Under the court decree of 1922 the packers disposed of their interests to the United Gas Improvement Company. At that time Mr. Kirk was made vice-president of the service company. Within the past year he had been recalled from semi-retirement to take active charge of the operations of the company. He was also vice-president of the Sioux City Gas & Electric Company and the Iowa Public Service Company.

New Equipment Available

Instantaneous Reclosing Three-Fuse Switch

An instantaneous reclosing "Fuswitch" equipped with three fused cartridges, each having a Matthews "Pullink," has been announced by the W. N. Matthews Corporation, St. Louis, Mo. Only one cartridge is in circuit at a time. A transient or short-circuit condition causes the fuse link of the cartridge in circuit to melt just below the upper contact, inside the cartridge. The link is instantly pulled out and thrown on the ground by straightening of the tensed "Pullink." When straightening, the "Pullink" in its rapid



upward motion moves a lever which causes the next cartridge to be driven into the contacts and the circuit is reclosed within 4 to 10 cycles.

If a transient or short-circuit condition causes this fuse link to melt or blow out the action is repeated and the next cartridge is connected. A trouble man can see at a glance if any or all of the links are blown by the position of the "Pullink." This switch is made in four ratings, 7½, 15, 23 and 34½ kv., 1 to 60 amp.

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A SERIES OF "NICHROME" ALLOYS, known as "Nichrome V," is announced by the Driver-Harris Company, Harrison, N. J. These alloys are especially equipped to meet requirements for longer life, quicker heating and greater overload.

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JOHNSON VARIABLE REDUCER which is designed to meet a definite need for a wide variety of industries, an infinite variable speed reducer, self-contained, running in a bath of oil, is announced by the Smith Power Transmission Company, Cleveland, Ohio. It will give infinite speed control from zero to any desired speed, it is claimed, using a control that is visible and quickly manipulated and a stopping position that is superior to a clutch, as the unit stops instantly, having no high-speed inertia to overcome.

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Improved Grinders and Undercutters

Improvements in power mica undercutters and portable precision grinders have been announced by the Ideal Commutator Dresser Company, Sycamore, Ill. The undercutter is flexible shaft driven, yet because of the gearing in the head the vibration of older designs of flexible shaft-driven machines is entirely absent. It has the advantage of smooth operation and a leading cutter, as in the earlier direct-connected machines, yet the motor hangs out of the way, behind the operator. The grinders, in which the use of the "Ideal" resurfacer is recommended, but which also will accommodate steel tools, are made in three sizes, midget, perfect and ideal models.

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Power Fuse for Outdoor or Indoor Service

For outdoor or indoor service, with interrupting capacity up to 600,000 kva., a Deion power fuse has been announced by the Westinghouse Electric & Manufacturing Company. Three voltage ratings are available, 7,500, 15,000 and 23,000, with renewable fuse elements in standard current steps ranging from 5 to 200 amp. Interrupting capacity varies with voltage ratings only; a change in the current rating of a fuse link does not affect the rupturing capacities at a given voltage. Calculated on the basis of three-phase power, the three standard voltage ratings of 7.5, 15 and 23 kv. have interrupting capacities of 325,000, 500,000 and 600,000 kva. respectively.

Some of the advantages are: The Deion elements can be slipped into place and the fuse is ready to be put back in service within an average time of one minute from removal of the holder from the mounting; the chamber is lined with inert boric acid in molded dry form; there is neither liquid nor loose powder to leak out or change chemically; since the Deion element is entirely self-contained, there is no need to seal the fiber and porcelain holder into which it fits against leakage; thus the end of the holder is open to vent freely pressures developed during the operation.